FACULDADE DE CIÊNCIAS SOCIAIS E HUMANAS
UNIVERSIDADE NOVA DE LISBOA

INSTITUTO DE TECNOLOGIA QUÍMICA E BIOLÓGICA /UNL
Knowledge Creation

Nitrogen (N): from science to society

Science Communication Project

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Lisboa (Março 2014)

Trabalho de Projecto apresentado para cumprimento dos requisitos

necessários à obtenção do grau de Mestre em Comunicação de Ciência

Realizado sob a orientação científica do Professor Doutor Carlos Catalão

Aos meus netos,

Catarina Matilde

Inês Maria

Vicente Afonso

Agradecimentos

"It does not matter how slowly you go as long as you do not stop."

The Sayings of Confucius

Uma dissertação é um trabalho individual, aprofundado, que permite avaliar um percurso académico. Neste caso, em particular, individual, mas não isolado, transversal, mais do que profundo e pessoal mais do que académico.

Um percurso faz-se caminhando, de forma livre mas solidária. Para chegar a este ponto não posso deixar de reconhecer o apoio incondicional, a liberdade de escolhas, os desafios simples, mas profundos, os conselhos e incentivos e as palavras correctas nas horas certas, do meu orientador, o Doutor Carlos Catalão. Fico-lhe muito reconhecida pelo benefício recebido.

Uma palavra especial aos coordenadores do mestrado, Doutora Ana Sanchez e Doutor António Granado por me terem seleccionado como aluna. Foi um desafio enorme partilhar conhecimentos e trocar ideias com colegas da idade dos meus filhos. A eles agradeço o terem-me aceite no "grupo". Foi um verdadeiro rejuvenescimento poder ser de novo aluna; eu, que nunca deixei de estudar.

Não posso deixar de referir e agradecer a disponibilidade, confiança, entrega e entusiasmo dos professores, educadores e investigadores que convidei para realizar a consulta pública em Portugal, usando pela primeira vez a metodologia focus group como método de abordagem.

Do meu grupo de investigação da Faculdade de Ciências da Universidade de Lisboa recebi surpresa, mas apoio incondicional, dúvidas, mas controlo sobre as metas a cumprir, respeito pelos silêncios e ausências, necessários à introspecção e estudo. Uma palavra especial para a Cristina Cruz, Cristina Branquinho e Teresa Dias pelas suas ideias e críticas sempre oportunas.

Ao meu marido, por estar sempre a meu lado, agradeço o respeito pelas minhas opções e por me conceder a liberdade de escolhas.

Nitrogen (N): from science to the society

A Science Communication Project

Maria Amélia Martins-Loução
Mestrado em Comunicação de Ciência • Março 2014

Resumo

O Azoto (N): da ciência para a sociedade é um projecto de comunicação de ciência que tem por objectivo consciencializar os jovens para as ameaças que o azoto (N) em excesso traz para a humanidade. Pode ser dividido em duas partes. Uma, de investigação, sobre a análise de resultados de uma consulta pública realizada entre professores, usando o método qualitativo do focus group, para compreender a sua sensibilidade e propostas de solução para minimizar o excesso de N no ambiente. Os resultados obtidos foram instrumentais para o desenvolvimento da segunda parte. Esta segunda parte é uma proposta de projecto a submeter ao Horizon 2020, no âmbito da "Science with and for Society ". Nela se propõe uma abordagem educativa trans-disciplinar, conseguida através da interacção entre docentes do secundário, e do ensino superior, associação de pais e organizações cívicas não governamentais, com vista à consciencialização dos jovens para as ameaças do N em excesso no meio ambiente, fazendo o enquadramento científico e fornecendo abordagens tecnológicas. A inovação desta proposta baseia-se: (i) no acompanhamento e desenvolvimento profissional dos docentes do secundário, (ii) na motivação dos estudantes a desenvolver o seu próprio estudo e pesquisa com a tutoria dos docentes, da escola e do

ensino superior, e (iii) no desenvolvimento de capacidades de comunicação dos jovens para exercer uma cidadania activa em prol da minimização das ameaças do N.

Palavras chave: azoto, comunicação, consulta pública, focus group, responsabilidade social e científica, trans-disciplinar.

Abstract

Nitrogen (N): from Science to Society, is a science communication project focused in raising students' awareness on N issues. It can be divided in two parts: one, empiric, where a public consultation has been performed and analysed, using the focus group method, to tackle teachers understanding about N threats. The data collected served as a driver of the second part. This second part is a proposal to Horizon 2020, following the call Science with and for Society. This proposal aims to raise student's awareness of the different aspects encompassing science and technology of nitrogen (N) in biosphere in their societal content. To reach that outcome the proposal promotes a cross-cutting interaction between the different levels of education system, research and school institutions, as well as parents' association, and other civic society organisations. The innovation of this proposal stands on the following priorities: (i) boost quality in teaching, (ii)provide learning strategies to promote students awareness of the importance of trans-disciplinary approach, and (iii) develop students' dissemination skills towards an active citizenship change about N threats.

Keywords: citizenship, communication, focus group, nitrogen, responsible research, trans-disciplinarity.

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Preâmbulo

"Choose a job you love, and you will never have to work a day in your life."

The Sayings of Confucius

Esta dissertação foi preparada e desenvolvida para a parte não curricular do Mestrado em Comunicação de Ciência. Combina dois trabalhos distintos: (i) um trabalho de investigação de consulta pública, realizado em Portugal; (ii) uma proposta de projecto a apresentar ao Horizon 2020. Assim, a dissertação é redigida, tanto em português como em inglês.

A consulta pública, que utiliza a metodologia qualitativa usada em ciências da educação denominada Focus Group, foi preparada, apresentada e analisada em Portugal, e para a realidade portuguesa. Constituiu um verdadeiro trabalho de investigação, que pretendeu avaliar o conhecimento dos professores sobre os riscos do N e a sua acumulação no meio ambiente. A questão do azoto e a justificação da sua escolha é apresentada na introdução.

No 1º Capítulo a consulta pública, utilizando a metodologia focus group, tem os aspectos introdutórios e metodológicos em inglês em coerência com o resto da dissertação que trata da proposta de projecto. Foi aplicada e trabalhada com um grupo de professores portugueses, no dia 18 de Janeiro 2014, no Jardim Botânico da Universidade de Lisboa. As questões formuladas, a análise das respostas e a sua discussão são, por isso, apresentadas em português. Os resultados obtidos desta investigação foram instrumentais para o desenvolvimento da proposta de projecto ao Horizon 2020. Foi esta investigação que justificou todo o direccionamento do projecto, a

selecção do grupo etário de estudantes e a organização das tarefas.

O 2º Capítulo, sendo uma proposta a submeter ao Horizon 2020, é todo redigido em inglês e segue as indicações publicadas para as pré-candidaturas. Porquê um projecto europeu? Porque o problema do N é um problema europeu, de elevada dimensão e de repercussões ainda pouco conhecidas. Urge ser abordado de forma global para que a comunicação seja efectiva e leve a mudanças sociais rápidas, eficazes e duradouras. Sendo uma proposta hipotética, há aspectos pouco ou nada desenvolvidos como seja a descrição do consórcio, a estrutura de gestão e de financiamento que num consórcio nunca pode ser redigida apenas pelo coordenador, mas antes pelo conjunto, após troca de experiências e aspectos práticos discutidos e apresentados por todos os membros envolvidos.

As conclusões, no final, voltam a ser redigidas em português para resumir tudo o que foi dito ao longo desta dissertação, mostrando o fio condutor do projecto em comunicação de ciência.

Introduction

"Everything has beauty, but not everyone sees it."

The Sayings of Confucius

A clear task for future nitrogen policy in the EU, and globally, is to increase the awareness of the role of nitrogen in myriad processes and impacts, and whether they have a positive or negative net outcome for society. Central to achieving such increased awareness is the use of audience-tailored messages on the role of nitrogen.

To effectively communicate the European nitrogen issue requires the recognition of the issues that are most important to the target audience, their level of awareness, and the ultimate outcome that is desired as a result of the communication. For climate change, (O'Neil and Hulme 2009) have suggested the use of an 'iconic' approach. In the case of reactive nitrogen, a similar approach could also prove successful. Which icon is used will depend on its importance to the target community and how robustly the link between nitrogen and the highlighted consequences can be made.

The nitrogen 'issue' is a complex one. Like climate change, such complexity necessitates well thought-through messages and tools to make the information accessible to a wide range of audiences. There is a requirement for useful analogies and metaphors to be developed that will better help communicators get their message across. Similarly, the further development of tools, educational resources, games, stories can help communicators and educators reach stakeholder groups (e.g.

children, young students).

According to the European Nitrogen Assessment (ENA) we both need public awareness and more "policy" awareness of nitrogen (Reay 2011). And this because increased awareness of the nitrogen issue may be able to change behaviour in certain groups of individuals and to highlight potentially antagonisms and significant synergies that reinforce the putative policy's aims. Thus, a 'segmented' approach to engendering choice, behavioural change and communication is required. This approach is one that will need to evolve as attitudes, awareness and policy aims change over time. The best stakeholders to reach are students, the young generation that need to increase their citizenship role in the society. Previous findings support that teachers are crucial for the success of students' involvement and further motivation (Wakimoto and Lewis 2014).

In the long term, a 'mainstreaming' of nitrogen issues in European policy – as already exists in many sectors for carbon – may rise from a youth responsible citizenship providing a strategy by which many of the knowledge gaps, overlaps and antagonisms can be effectively addressed. Embedded by the scientific knowledge, young generation are able to develop the skills to approach it in a societal context communicating much better the nitrogen challenge and delivering it far-reaching Europe and the world.

This thesis aims to purpose the development of a European proposal on science and education in line with the call for creating innovative ways to make scientific careers attractive to young people. And this was based with a previous experience on an active participation on building and writing ENA (The European Nitrogen Assessment) and on the recent knowledge acquired by public consultation for perceiving teachers views and understandings.

The thesis is structured in two major chapters. In the first, the description of the public consultation, using focus group methodological approach. The results functioned as the main driver for the development of a proposal for a putative submission to Horizon 2020. Chapter two is *the* proposal filled according with the call template. Last, but not least, conclusions will sum up the science communication project. The support information developed for the public consultation preparation is annexed.

Chapter I - Public Consultation

"Learning without thought is labor lost; thought without learning is perilous."

The Sayings of Confucius

1. Using Focus Groups

The focus group method in social research is a qualitative research method, increasingly used in political and social sciences, designed to unravel the in-depth structure of people's values and beliefs (Morgan 1997). In other words, the focus group method produces the underlying reasons why people have particular views, opinions and ideas. Focus groups are a form of group interviews (Morgan 1997). A moderator guides the interview while a small group discusses the topics that the interviewer raises.

Over the past decade, many organisations have learned what focus groups are. Government agencies, nonprofit organisations, academic researchers and public relations experts discovered the value of focus groups (Kitzinger and Barbour 2001). From a practical point of view the critical question is not what focus groups are but what we can do with them, and particularly, how to do it. In academia and in science education research, too, focus groups have attracted increasing attention. In the last decade there has been an increase in the number of focus group studies published in academic journals (Neumark-Sztainer, Story et al. 1999)(Kitzinger and Barbour 2001).

Although still an under-utilised method, the focus group is very flexible, able to elicit the group participants' particular ways of thinking and talking about a topic.

This openness and flexibility is needed because the views, opinions and ideas are social constructs. They are heavily dependent on the personal, historical and cultural context in which we live and work (Kitzinger and Barbour 2001). The group is "focused" in that it involves some kind of collective activity. Focus groups are distinguished from the broader category of group interviews because it uses the group interaction to generate data (Cohen, Manion et al. 2005).

The invention of focus groups holds that if you bring small groups of participants together, make them feel at ease and ask them a series of slowly more critical questions. They are heavily dependent on the personal, historical and cultural context in which we live and work. Focus groups are group discussions exploring a specific set of issues and how point of views are constructed and expressed. The method provides the opportunity to gain in-depth insight into ideas, values, wishes and concerns of participants and stimulate shared creative thinking (Cohen, Manion et al. 2005).

It seeks understanding of a research topic from a particular perspective and the activity of the participants is collective, in the sense that they are all engaged in a group conversation about the topic from their own experience. Thus, all focus groups must be short in number to take advantage of this methodology (Basch 1987). Focus groups generally consist of 6 to 12 participants, depending on the goal and structure, and usually takes around two to three hours.

Focus groups generate a large variety of opinions and ideas that gives insightful information, while a specific focus during the discussion is maintained. They are fundamentally a way of listening to people and learning from them. Are also places of social interaction where meaning and understandings are actively constructed and negotiated.

To be effective in increasing society understanding scientists need to engage actively with teachers through different communication strategies to have an increasing role in youth. Focus groups is a useful methodology to approach in this particular subject. For society to respond requires awareness of the complexity of the nitrogen issue, the trans-boundary nature of most nitrogen fluxes and, most importantly, its direct relevance to them. In schools, including higher education, the curricula are subject to only periodic validation procedures. They are necessarily slow to respond

to changing scientific understanding. It urges an effective communication between scientists and teachers and these with students.

To understand the diversity of views, values and attitudes of teachers, a focus group was organised aiming at obtaining data about teacher knowledge and awareness of N risks.

2. Methodological requirements

2.1. Moderator competences

Focus groups don't just happen. Someone has to want to do them and someone has to do the work, the moderator. The surrounded environment is very important. It is rooted in the host/moderator's awareness that everyone is needed. Moderators are true hosts creating a spirit of welcome needed to make conversation as a generative force. The moderator's challenge is to mobilise the interaction patterns between participants, to carefully listen and to structure what is said and bring it in relation to the research objective.

Thus, the success of focus groups depends on the ability of the moderator, supported by the format of questions and exercises, to manage dynamic interactions between participants. Those dynamics will greatly influence the nature of the discussion and the results obtained.

2.2. Physical and social environment

- Environment should be noise free
- There should be enough space to relax, walk around and engage in the conversation.
- The social environment should be positive and non-threatening.
- Everybody should feel free to express his or her own ideas and concerns.
- All participants should feel appreciated.
- Participants can respond and build on the views expressed by the other participants.

- At the end members of the research team summarise what they have learned from the participants and ask for an evaluation through an anonymous questionnaire.

2.3. The size and time

- Consist of 6 to 12 participants
- Take 2-3 hours

2.4. The structure

Setting - all participants are introduced and presented. A focus group starts with sharing and collecting the participants' direct intuitions and associations on the topic of the focus group.

Contextualising - the topic is addressed by the moderator focusing key concepts to contextualise the aim of the focus group. Some intuitive stories can be used to underline concepts.

Collecting - the moderator repeatedly asks 'why questions' to find out what makes the participants see or believe things in a particular way. This is the first collection of participant views and concepts.

Clustering - the articulated participants answers are systematised, for example by clustering them into categories.

Inventorying - the moderator presents the problems or concerns related to the clustered categories.

Selecting - the line of argumentation of the participants regarding positive and negative aspects of the case example.

Deepening - the moderator focuses on the most relevant or prioritised topics and the process of association; articulation and systematisation recommences.

Converging - visualises the outcomes of discussions and exercises on flip charts to make sure the group is able to continue working on the material that has come up in their interaction.

Prioritising - the moderator ask the participants to assign one or more solutions that should be prioritised due to the importance of the problem. Final discus-

sion about the prioritisation choices.

Conversations and discussions are recorded during the whole session.

The moderator promotes a full discussion and summing up at the end of the focus group. Before closing the session, a post-questionnaire is distributed to all participants for full evaluation.

2.5. Ethical issues

The group of people selected for the focus group needs to get a realistic understanding of what is involved in the decision to do the focus group. Previously, the host researcher shall make a clear case about what kind of information focus groups will deliver. In most part of these groups a audio and a video-recording is advisable for data storage. At the beginning of focus group all the participants are then asked to sign an informed consent form and informed that they are free to withdraw any time, if something doesn't please them.

2.6. Data evaluation

All the informations collected during the session, either the written post-its or recorded conversations are evidences to be further analysed.The data obtained during the focus group and the questionnaire are analysed and summed up.

3. Case Study: the Portuguese Consultation

3.1. Composição do Focus Group

Género (M/F)	Idade	Localidade de Origem	Escola/Instituição	Disciplina responsável/Act. Profis-sional	Nível de escolaridade
F	43	Torres Vedras	Escola Madeira - Torres Vedras	Ciências Naturais	Licenciada
F	45	Belas	CED-NªSrªda Conceição-CPC	Física-Química	Licenciada

Género (M/F)	Idade	Localidade de Origem	Escola/Instituição	Disciplina responsável/Act. Profis-sional	Nível de escolaridade
F	40	Lisboa	EscSec Maria Amália Vaz de Carvalho	Biologia-Geologia	Mestrado
M	49	Costa Caparica	Museu Nacional de História Natural C	Serviço Educativo/ Zoologia	Licenciado
F	41	Alfragide	Museu Nacional de História Natural C	Serviço de Comunicação	Doutorada
F	45	Alfragide	Agrup Escolas Almeida Garrett	Ciências Naturais	Licenciada
F	49	Alfragide	CED-NªSrªda Conceição-CPC	Ciências Naturais	Licenciada
F	52	Ericeira	Básica de Mafra	Ciências Naturais	Licenciada
M	34	Lisboa	Museu Nacional de História Natural C	Serviço Educativo/ Botânica	Mestrado
M	35	Évora	Núcleo Museológico Évora	Professor Desempregado	Licenciado
F	39	Lisboa	Museu Nacional de História Natural C	Serviço Educativo/ Botânica	Doutorada
F	34	Foros de Amora	CED-NªSrªda Conceição-CPC	Geografia	Licenciada
F	35	Cascais	Centro de Biologia Ambiental	Investigadora	Doutorada

3.2. Guião do Focus Group (vide anexo)

Explicar - Explicação sobre o que é o focus group

Avaliação de conhecimentos - Qual a importância dos fertilizantes para a população humana.

Contextuar - rever conhecimentos sobre o papel do azoto e dos fertilizantes azotados na produção vegetal e de alimento. Noção de azoto reactivo no ambiente.

Inventariação de conceitos - os fertilizantes e os custos energéticos e ecológicos. Custos e benefícios da nossa sociedade.

Selecção de conceitos - o azoto na sociedade e nos bens de consumo.

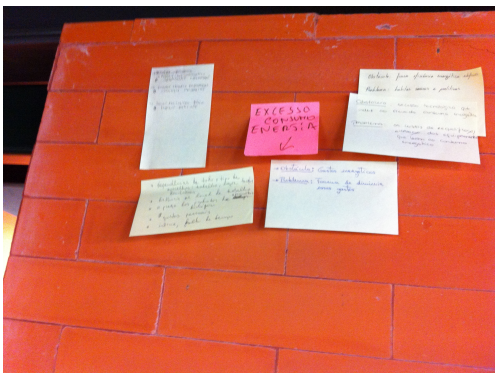
1º Exercício: a título individual com que vector contribui mais para a produção de azoto reactivo.

Explorar os conceitos - quais os desafios que se colocam à sociedade. Quais os problemas que se antevêem.

2º Exercício: a título individual, definir um obstáculo para a redução do azoto no sistema e o problema que antevêem que impede a remoção do obstáculo.

Pede-se a um dos participantes para informar qual o obstáculo que identificou e os problemas que encontra para a sua resolução e posteriormente pergunta-se a cada um dos outros participantes quem tem resposta semelhante.

São agrupadas as respostas semelhantes.



3º Exercício - pensar, em grupo, as soluções para os problemas. Colocar uma solução em cada folha.

Priorizar - perante as soluções propostas e sabendo que possuíam uma quantidade de dinheiro para investir em qual delas colocariam o vosso investimento?

4º Exercício: a título individual, cada um faz a sua opção. Ou seja, cada um coloca o investimento na solução que considera mais adequada.

No fim deste exercício os participantes são convidados a explicar as suas opções e o seu investimento, gerando uma discussão global sobre os resultados obtidos.


3.3. Resultados e Discussão

Foram encontrados quatro grandes obstáculos para minimizar as emissões de azoto:

- Consumo de energia
- Consumo global (alimentar, roupas, outros)
- Plásticos
- Transportes

Foram identificadas diferentes soluções para remover os obstáculos, a grande maioria relacionada com processos industriais e resoluções políticas. Posteriormente, o investimento recaiu essencialmente nas seguintes soluções, por ordem decrescente:

- Melhoria da rede de transportes públicos - 9 milhões
- Conversores de energia - 8 milhões
- Legislação para permitir a venda de produtos a granel - 5 milhões
- Fomentar a dieta mediterrânea - 4 milhões
- Melhorar os movimentos cívicos - 3 milhões
- Dinamizar os produtos locais - 3 milhões
- Melhorar a eficiência energética na construção - 2 milhões

- Incentivos financeiros ao consumo para reduzir energia - 2 milhões
- Alteração dos padrões de consumo energético - 0 milhões
- Fomentar e valorizar trocas de objectos - 0 milhões
- Partilhar transportes - 0 milhões

Os resultados obtidos mostram que os participantes, mesmo tendo bases científicas, não encontraram soluções relacionadas com os impactos directos do azoto. Durante a contextualização teórica sobre o excesso de azoto no ambiente foi dado grande ênfase ao papel dos fertilizantes (produção, transporte e consumo), contribuindo com cerca de 90% para todo o azoto reactivo acumulado. Os restantes 10%, relacionados com a utilização de combustíveis fósseis e por isso ligados à energia e seu consumo, foram os que mereceram a maior atenção dos participantes. A questão energética, perfeitamente estabelecida na sociedade, foi assim a "mais sentida" e empolada. Os participantes reagiram com algum tipo de "moralidade" sobre o que acham correcto fazer (ou que deviam fazer) - apagar luzes, vestir roupas não sintéticas, usar transportes - e souberam passar o ónus dos problemas para uma entidade externa - melhor gestão de transportes, investimento em conversores de energia, legislação ambiental mais correcta, lobbies das companhias, excesso de empacotamento.

Os resultados dos questionários mostraram que os participantes não tinham ainda um conhecimento formado sobre os impactes dos fertilizantes no ambiente e para a saúde pública e que teriam gostado de saber mais. Denunciaram, ainda, alguma ignorância sobre o seu papel, enquanto cidadãos, na minimização dos impactos. Ou seja, mesmo depois da sessão do focus group não souberam dizer que tipo de acções, a título individual e familiar, passariam a realizar tendo em conta o que tinha sido discutido e apresentado.

Estes resultados podem ser explicados por:

i) serem participantes informados, reconhecem a necessidade de uma sociedade desenvolvida, com uma elevada consciência ambiental sobre as emissões de gases de estufa e o seu papel nas alterações climáticas.

ii) a selecção foi demasiado homogénea do ponto de vista de conhecimentos científicos, embora heterogénea em actividade profissional e local de trabalho. O grupo etário também tinha pouca variação (42 ± 6 anos de idade). Estas razões podem ter justificado alguma homogeneização de respostas, ou pelo menos pouca diferenciação nas soluções propostas.

iii) a compreensão dos riscos do azoto serem muito confundidos com a questão energética, o mercado de carbono e a mudança climática.

Estes resultados permitem reforçar a falta de compreensão que existe sobre o efeito do azoto no planeta e os riscos que a sociedade corre ao desligar-se do problema da produção de alimento, tipo de dieta alimentar e quantidade de desperdícios. O problema é complexo e problemático e, tal como o European Nitrogen Assessment (ENA) divulgou em 2011(Sutton, Howard et al. 2011), há uma necessidade urgente de comunicar e informar a sociedade sobre o problema, as suas ameaças e a necessidade de criar uma sociedade esclarecida e participativa na tomada de decisões.

O resultado desta consulta pública constitui a justificação para a elaboração de uma proposta a submeter à União Europeia (Capítulo 2) com vista aumentar a consciencialização da juventude para os riscos do azoto. Sendo uma proposta que privilegia a interacção escola-investigadores espera-se que, a longo termo, contribua para o aumento das carreiras científicas e para o desenvolvimento de uma cidadania responsável e informada. Sendo, ainda, uma proposta que envolve seis países europeus distintos, prevê-se que a troca de conhecimentos entre estudantes, o desenvolvimento de interacções entre professores, estudantes e cientistas de diferente nacionalidades possa aumentar e alargar a cidadania responsável e activa em torno dum problema actual da nossa civilização.

"If you think
in terms of a year, plant a seed;
if in terms of ten years, plant trees;
if in terms of 100 years, teach the people."

The Sayings of Confucius

Chapter II - Proposal Horizon 2020

1. General Information

CALL: Making Science Education And Careers Attractive For Young People.

SEAC: Innovative ways to make science education and scientific careers attractive to young people

Type of Action - Research and Innovation Action

Project Acronym - iN-Site

Proposal Title: Nitrogen (N): from science to society

Project Coordinator – Universidade de Lisboa

Duration: 36 months

Key words: citizenship, focus group, IBSE, nitrogen, responsible research

List of participant institutions:

Nº	Institutions	Short-name	Country
1	Universidade de Lisboa	UL	Portugal
2	King's College London	KCL	UK
3	Centre for Ecology and Hydrology	CEH	UK
4	Universitaet Innsbruck	LFU	Austria
5	Vrije University Amsterdam	VU	Netherlands
6	Universidad Politécnica de Madrid	UPM	Spain
7	Euromediterranean University	EMUNI	Slovenia

1.1. Summary

Project “IN-Site” focuses to raise student’s awareness of the different aspects encompassing science and technology of nitrogen (N) in biosphere in their societal content. Nitrogen is essential to life; yet, useable N in earth is so low that required the human alteration of N cycle to sustain the feeding of the world's population. The nitrogen story provides a clear example of global geo-engineering benefits. However, there is a gap between those who produce knowledge and people who will be affected. Understanding the risk of transgressed earth regulatory capacity and proposing innovative measures are urgent.

This proposal envisions an innovative education program directed to secondary school students for improving scientific understanding about N threats and the interplay between science, technology and sustainable society. The understanding of N scientific issues increases the number of future researchers who will be able to better address societal challenges, with innovation and promoting active citizenship.

To reach this outcome iN-Site fosters a sustainable and cross-cutting interaction between the different levels of the education system, research and school institutions. iN-Site (1) provides learning strategies to promote students awareness of the importance of trans-disciplinary approach, through a tutorial research program along the last three years of secondary education (research development, WP5, and implementation WP6), (2) boosts teacher pedagogical methods, as an instrumental effort (public consultation WP2, professional development WP4), and (3) supports sharing information to better address societal challenges on N threats, to help students in launching an active public engagement (dissemination, WP6) and developing new resources.

Seven partners and 11 research centres (science education and nitrogen expertise field) are involved in this project. The consortium has been involved in other previous successful EU programs showing a knowledgeable cohesion.

2. Objectives

To foster a sustainable and cross-cutting interaction between the different levels of the education system, research and school institutions, this project will look at the following priorities: provide learning strategies to promote students awareness of the importance of trans-disciplinary approach, boost quality in teaching, and develop student's dissemination skills towards an active citizenship change about nitrogen threats. With this in mind the specific objectives of iN-Site project are the following:

Specific Objectives	Work packages addressing the issue
iN-Site will make public consultation through the use of focus group approach to understand the teacher particular views, opinions and ideas about the risks of N in the environment.	WP1 Public Consultation
iN-Site will link different order education systems (university and secondary school) and different research expertise (science education and nitrogen science research teams) to assemble an interdisciplinary project, based on data obtained in focus group	WP2 Levelling
iN-Site will deliver a teacher and research refresh training about IBSE methodology, focusing on process-oriented skills to face the challenges of N threats through the evaluation of current development patterns, and individual behavioural choices.	WP3 Professional Development
iN-Site will promote school research on N effects in biodiversity, with the help of researchers and teachers tutorial.	WP4 Research development
IN-Site will encourage teachers to establish a research data centre, promoting a student permanent responsible engagement with experimental data formative assessment.	WP4 Research development
iN-Site will implement research plans and digital resources in 6 different countries. This includes links and interactions between teachers, researchers and students,throughout the entire project. The challenge is to obtain a combined response to emerging society changes, from the individual up to the local, national and international levels.	WP5 Research Implementation
iN-Site will support students gaining experience in inquiring and visiting companies and organisations related to N in a societal content (food, drug and environmental organisations)	WP5 Research Implementation
iN-Site will use online services to support the inquiry process and scientific dialogue among students, teachers, and researchers	WP6 Dissemination and Communication

iN-Site will promote the development of prototype communication tools, videos, online lesson plans, student journals, *inter-alia*, on the role of N on biodiversity and Human health - Development of N-Toolkit	WP6 Dissemination and Communication
IN-Site will run a final conference to disseminate the project outcomes on a European wide scale.	WP6 Dissemination and Communication
IN-Site will be promoted through networks including the EU central information provider for dissemination of best practices and research tools. Open-days, science fairs and scientist-teacher partnerships as well as other laboratory resources will be illustrated.	WP6 Dissemination and Communication
IN-Site will promote an European platform of best practices to assist in finding appropriate advertising tools to minimise N effects in the environment	WP6 Dissemination and Communication
iN-Site will ensure that formative assessment encourages the research design to be adapted to each individual country.	WP7 Quality management

3. Relation to the work programme

This proposal is embedded in the call for Making Science Education and Careers Attractive for Young People. Particularly, in raising awareness for trans-disciplinary research and responsible research and innovation.

iN-Site is designed to establish a cross-cutting interaction between different levels of education (Universities and Schools), research institutions (Research Unit Centres) and other Civil Society Organisations (Parents Associations, Food and Drug and Environmental organisations). With these interactions young people work with research transversal questions, face real daily life problems, understand the role of science on policy-maker decisions and ethics value.

iN-Site expects to improve student's scientific understanding about the threats of N, and student's awareness on how simple actions can be translated into big consequences with impact on society and our daily life. The understanding of N scientific problems will engage students to pursue scientific careers, and to set the research agenda for Europe's active and responsible citizenship targets.

4. Concept and Approach

Project "IN-Site" is conceived to support activities linked to innovative approaches in the field of science education and scientific careers, encompassing science and technology of nitrogen (N) in biosphere in their societal content.

IN-Site will use three core concepts to facilitate positive outcomes:

- students must have the responsibility for their own learning and research development (***Responsible Research and Innovation, RRI***)
- research and problem simulations must come from inquiry and problem-base learning through the collaboration and mentoring offered by experts (***Innovative science education***)
- innovative communication is essential to create a link between science and society (***knowledge-based society***)

Responsible Research and Innovation iN-Site will embed the youth community on the need for understanding the nitrogen challenge with multidisciplinary research approaches in schools, in tune with their formal current educational *curriculum*. Research questions will be designed according to scientific methods and investigated by K-16 group of students. The research activities of the students will maintain throughout the entire project. Visits and interactions with CSO, such as food and drug organisations, will help to frame students collected information within the societal context necessary for tackling N societal challenges more effectively and in a more trans-disciplinary manner. Those interactions will function as incentives for students to pursue higher education careers using responsible research values

Innovative science educationTeachers from different disciplines will receive a refresh training about IBSE methodology focusing on process-oriented skills and self-directed learning. A permanent dialogue between scientists, teachers and students will encourage critical thinking, evaluating evidence, cooperative learning, and reflection.

Knowledge-based societyThe information and the data collected by students with the supervision of researchers and teachers, will allow the creation of a N-

toolkit, as an outcome product. Skills for a responsive knowledge-based and improved communication tools will be stimulated.

5. Ambitions

The iN-Site consortium is based on previous work collaborations on N science research - COST 729, NINE from the 7th framework program and European Nitrogen Assessment group - and on basic science education pedagogical methods, such as the INQUIRE project. The concepts beyond the state-of-the-art background are used to develop an innovative program focused on attracting young students to scientific careers through the development of responsible research and innovation.

iN-Site ambitions are based on 5 major innovative dimensions underpinning the rational of the present proposal.

5.1. The need of Responsible Research and Innovation (RRI)

Innovations: The generation of a responsible science knowledge on secondary school students requires a cross-cutting trans-disciplinary interaction. This involves different disciplines in school, tutorial work by researchers, and the contact with representatives of parents association, food and environmental organisations. These interactions offer new opportunities for young students: (i) to entail various degrees of science integration and experimentation; (ii) to build trust and confidence in scientific institutions, which is crucial for creating the appropriate attitude to tackle societal problems; (iii) to produce new and insightful knowledge and solutions for planned changes towards a responsible and socially inclusive science.

Expected outcomes: The embedding of RRI in the last three years of school curricula based on a tutorial mentorship will help Schools and Higher Education Institutions to shape future responsible and responsive researchers. The program activities proposal will foster sustainable and cross-cutting interaction between Secondary Schools and Higher Education system, research institutions and Civil Society Organisations (Parents Association, Food and Environmental Agencies). At the end of this program, students will be able to better frame scientific research in a societal con-

text, and to place more emphasis on a science knowledge society.

The State-of-the-art behind: Over the past years, several studies have shown an increasing divergence between the EU citizen's attitude and the goals defined by the EU for science and technology. Previous 'techno-disasters', together with the many facets of the current financial crisis, have resulted in a loss of public trust (Commission 2012). Apparently, the "fuzziness" of contemporary knowledge associated with the decision-making process, uncertainty and ambiguity of responses towards real societal problems are important claims against science trust (Council 2013). The lack of trust is invading society, families and their children. This public disappointment leads to reflections of European policies and some key insights towards the targets of Europe 2020 were feeding forward. New approaches involve a focus on research and on products of innovation to achieve a social or environmental benefit (European Commission (COM 2012 2012).

According to the late Interim Evaluation and Assessment of future options for Science in Society Actions(Sutcliffe 2012), "Responsible research and innovation" (RRI) is a fairly new concept within the European Research Area (ERA).

> ***RRI is about trying to get better at anticipating problems, taking into account wider social, ethical and environmental issues and being able to create flexible and adaptive systems to deal with these unintended consequences.***
>
> *Sutcliffe, 2012*

In August 2013 the Science and Technology Advisory Council of European Commission provided more insights about the ways to change positive attitudes towards an inclusive knowledge society (Council 2013). This policy paper advises that more emphasis should be placed in the science curricula of schools to reflect a new understanding of knowledge and provide guidance on how to handle complex questions. This means to promote a culture of responsibility, to create a more holistic thinking and new methodologies of science communication, needed for enabling participatory processes.

Unfortunately, curriculum contents in school textbooks lead students into the experience of "information", but omit practical aspects of research models,

either real experimental ones or data results evaluation. Also, interdisciplinary at schools is not so common since many parts of subject matters are given on isolated fractions. Trans-disciplinary research involving transcending disciplines and engaging non-academics throughout the research process (Rice 2013) as iN-Site proposes is rather uncommon in schools and constitutes a challenge endeavour for attracting young students to scientific careers.

5.2. The nitrogen (N) issue

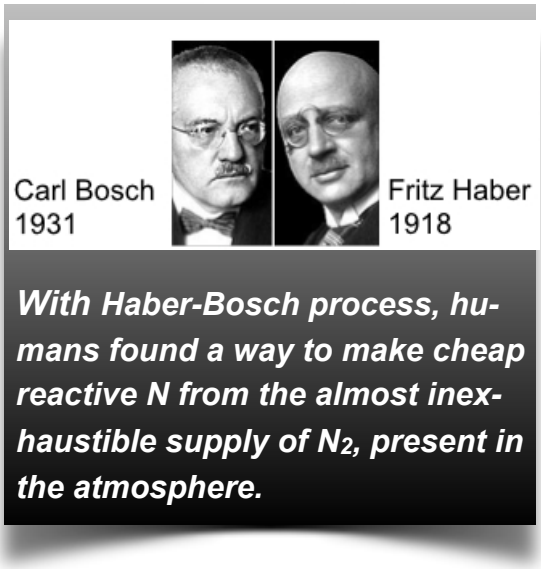
Innovation: Students are engaged to work in small teams to develop a scientific understanding about the threats of N in earth, under teachers and researchers mentoring. Teams brainstorm together and make team decisions about their research question, experimental design, predictions, and interpretation, with online and *in situ* research mentorship. Each team keeps and records his/her own data. The development of a multidimensional educational tool would assist in spreading out the data and user experiences: the "N toolkit".

Expected outcomes: The development of a "N toolkit" as an educational resource about the effects of N on earth reflect a new understanding of knowledge and provide guidance on how to handle complex questions, such as the N issue. This educational resource, developed by european students, will support educational curricula, further engagement with N science and technology and public awareness about the risks faced by society. The establishment of a link between theory and practice makes students more interested in research and innovation processes, and more sensitive to the relation between science and technology in practical terms.

The State-of-the-art behind: Nitrogen is essential to life; yet, useable N in earth is so low that required the human alteration of N cycle to sustain the feeding of the world's population. The release of nitrogen oxides to the atmosphere during fossil fuel combustion raised the impact. The need for food and energy on the one hand and the environmental and health impacts on the other, has caused conflicts between different objectives in the society.

The reactive nitrogen supply from fertilisers production and fossil fuel burning, has a myriad of effects on waters, soils, and the atmosphere (Rockström, Steffen et al. 2009). Increased N availability threatens many natural and semi-natural

ecosystems (Pinho, Theobald et al. 2012), since their stability is dependent upon low soil fertility (Dias, Malveiro et al. 2011)(Dias, Martins-Loucao et al. 2012).



Students need to understand how different nitrogen threats may be inter-related, including assessment of the costs and benefits of different nitrogen forms in the environment. This requires an interdisciplinary approach with the involvement of different disciplines. Students will be involved in simple research experimental designs and in existing activities (N and ecological footprint). The interplay between N science, technology and social needs will help the construction of "N toolkit". With this construct the students increase the awareness of the role of N in a myriad of processes and impacts and whether they have a positive or negative outcome to society.

5.3. Societal choice and nitrogen challenge

Innovation: A shift towards students pro-environmental behaviours is achieved through a responsive knowledge-based and improved communication tools about N risks. This is based on proactive systems: learning – through interaction between disciplines –; tutorial mentorship - to promote a process-oriented skills -, trans-interaction - between diverse actors and sectors ranging from student's families to organisational and managerial competencies -; use of frontier technologies - multimedia, web, radio -; and integration for critical reflection on the role of science in global sustainability and on the limitations of nitrogen policies.

Expected outcomes: Students will clarify their roles, their citizen's responsibilities and their rules of social engagement. They will be able to leverage research expertise and social opinion of N risks, to understand how simple actions translate into big consequences and how this impacts on society and daily life. Students will acquire innovative forms of communication to highlight their new scientific knowled-

ge towards a responsible engagement with society. Increased awareness of the N issue may be able to change behaviour in society and justify student's attraction for scientific careers.

The State-of-the-art behind: The global demand for food is rapidly increasing. It is understood that high productivities are needed in order to guarantee a well-nourished population on a global scale. However high productivities may also encourage changes in the productive chain and social cultural habits, disrupting the connection between crop productivity (and production) and human health (Kahiluoto, Kuisma et al. 2013).

Atmospheric emissions of nitrogen oxides and ammonia are contributing to a number of negative effects of human health and ecosystems.

Anthropogenic increase of N in waters are dangerous for human health.

ENA, 2011

One way to conciliate good nourishment of the human population is to change dietary consumptions. Traditional dietary habits of the Mediterranean area have been associated consistently with a lower incidence of cardiovascular disease and cancer.

Public and institutional awareness of N challenge remains very low across Europe (Sutton and van Grinsven 2011). And this means that both awareness of its importance and the responses to the causes can be low or non-existent. This proposal offers the chance for significant improvements in nitrogen-related communication and knowledge exchange within schools, student families, teachers and ultimately, general public. The partners have been previously engaged together (COST 729, NINE, ENA) and have a precise knowledge about the needs of youth involvement, their level of awareness, their interest of understanding the risks, their integration in school curriculum and their skills on communication. An integrative view of the N problem awaking and communicating the pros and cons of the nitrogen use taking into consideration the local and global needs and perspectives is the present challenge.

5.4. Public Consultation

Innovation: This proposal uses the focus group method to consult the diversity of views, values and attitudes of teachers, from different disciplines within a school area, about their perceptions of N risks. The amount of data compiled in different countries and schools is used to address the further learning and research program implementation.

Expected outcomes: An European gain of powerful insights into the views and opinions of teachers about N impacts, its importance and the responses to the their causes. The data collected will serve teachers, as players in learning process, to implement a program development, within the educational curriculum, to help secondary school students to acquire an integrate scientific knowledge on the meaning of N sustainability.

The State-of-the-art behind: The focus group method in social research is a qualitative research method, designed to unravel the in-depth structure of people's values and beliefs (Morgan 1997).

> ***Focus groups create lines of communication.***
> ***This openness and flexibility is needed because views, opinions and ideas are social constructs.***
>
> *Kitzinger and Barbour, 2001*

In academia and in science education research, too, focus groups have attracted increasing attention. In the last years there has been an increase in the number of focus group studies published in academic journals (Neumark-Sztainer, Story et al. 1999)(Kitzinger and Barbour 2001).

The focus group is a very flexible method that is open to the group participants' particular ways of thinking and talking about the topic (Cohen, Manion et al. 2005). Instead of asking questions of each person, focus group researchers encourage participants to talk to one another through a planned discussion designed to obtain perceptions on a defined area of interest. Focus groups are group discussions exploring a specific set of issues and how point of views are constructed and expressed.

A previous focus group was organised to tackle teachers understanding about N threats and test emerging hypotheses of minimisation (see Chapter 1). In this previous focus group the people were selected on the basis of some shared experiences in teaching level. The data collected served as a driver for this project. The most part of answers were related with the threats and benefits of "carbon" to society (e.g. energy use and climate change). This means that the suggested mitigation effects were all related to behavioural change strategies to achieve greenhouse gas emission reduction and decision support tools. Key factors related to societal choices, such as type of food production, type of consumption and waste reduction were rarely mentioned as influencing nitrogen challenge. Thus, the data obtained in this preliminary focus group was precious to confirm the need of consistent messages communication.

5.5. Innovative science education

Innovation: Implementation of IBSE methodologies on secondary education to: (i) help teachers promotion at individual and school levels; (ii) encourage a reflective practice of teachers own learning and teaching practices; (iii) justify teaching staff give more space to students work and make them think for their owns. The interplay between teacher regulation (teacher determines the students' learning processes) and student self-regulation of learning (teacher and research mentorship stimulate students to learn actively) is an innovative topic in contemporary theories of teaching and learning to put in practice in this proposal.

Expected outcomes: An effective practice on IBSE is expected to raise an innovative science education to engage students in a democratic, knowledge-based society. Students will develop their ability to understand the nature of science, as well as to question, access scientific data, share knowledge, work in groups and communicate results. The teacher and research mentorship throughout the entire project will attract young students for scientific careers and will induce innovative and simple messages about nitrogen challenge.

The State-of-the-art behind: Schools all over the European Union have been changing science teaching pedagogy, through the application of the Inquiry-Based Science Education (IBSE) method. IBSE promotes students' curiosity and observati-

ons, followed by problem solving and experimentation; through critical thinking and reflections, students are able to make meaning out of gathered evidences (Rocard, Csermely et al. 2007.).

From previous experiences acquired within the INQUIRE project (SCIENCE-IN-SOCIETY-2010 nº 266616), teachers following an IBSE training course acquired pedagogical knowledge to motivate their students and engage them on scientific oriented questions (Martins-Loução, Gaio-Oliveira et al. 2012). Teachers felt fulfilled, interested and able to share their experiences with their colleagues, having a true reflective practice on their own learning process. According to teachers' testimonies, student's performance was improved, indiscipline was reduced and all classroom was stimulated and motivated to learn (Martins-Loução, Gaio-Oliveira et al. 2013).

> ***European countries have been made a great effort to improve science education over the last decade, with the main purposes of promote a positive image of science, particularly of raise students' interest in science subjects.***
>
> *European Commision Report, 2011*

The members of the consortium are well experienced in inquiry-base teaching and learning, in training teachers about IBSE as well as in research related to science education. Part of the members have been involved in a recent European project (INQUIRE) and have already had good experiences in promoting and disseminating IBSE training courses as part of the same group. This gives a higher cohesion to the members of this consortium also specialised on N scientific issues. To be effective, the refreshing course on IBSE is an instrumental option to engage actively the teachers on N understanding and perceived complexity of such issues. Interdisciplinary teacher groups will be promoted within each school to approach N from different perspectives always complementing the normal curriculum. An informal presence of researchers within this training course is also crucial due to their pivotal role in students mentoring.

6. Impacts

6.1. Expected Impacts

Innovative science education

iN-Site supports and promotes quality and innovation in education by developing a sustainable and cross-cutting interaction between different levels of the education system, higher education and secondary school institutions. This interaction will be promoted in 6 different countries and will cover around 1000 students at the end of their school education. Besides this cross-cutting interaction those students will be able to contact other establishments, industry, Civil Society Organisations to perceive N risks in each country and exchange knowledge between countries. All these enhanced links allow students to gain an European vision of societal problems focused on N challenge. The program will contribute towards achieving the Europe 2020 education target by rising the number of young students with scientific skills more prepared to follow scientific careers.

Increase the number of researchers and innovators

iN-Site will contribute towards seeding RRI principles at the secondary school, covering around 1000 young students in 6 different countries in Europe. Seeding the RRI principles at this early stage will increase the social benefit and social relevance of European R&I. This impact can be snowballing through the development of "N-toolkit", the educational resource that will be freely available. Through an effective tutorial mentorship the students will improve their scientific skills to facilitate and ensure others students' engagement according with the knowledge-base society principles

Increase awareness of European N challenges

In six different countries and covering at least 1000 students, succinct messages get across families and friends of those students with the potential to influence societal choices. Through the dissemination of "N toolkit" and other communication tools developed by students within this project, media, policy makers and public will

be aware of nitrogen impacts. The recognition of the N challenges driven by those students and their families will overpass the partners group, enlarging the European impact in determining the adaptation choices society can make.

7. Measures to maximise impacts

7.1. Dissemination and exploitation of results

During the first year of the project dissemination of information concerning the project will be limited to project partners and the EU commission project officer. During the following years the purpose will be to raise awareness about iN-Site principally through education channels, both at school and higher education levels.

A budget is identified for dissemination of the results. Activities will include:

- publishing the project abstract in educational journals and the whole forum of International Nitrogen Initiatives
- publishing on the iN-Site web site
- producing the N-toolkit and make it available on iN-Site web site
- publishing results of focus group obtained in each country
- publishing data of school research group from each country
- preparing posters /oral presentations for international meetings
- disseminating press releases to the public media such as local newspapers, magazines, television etc. Each national group is responsible for contacting their local and national media
- disseminating the communicational strategies to other schools.
- distributing leaflets about iN-Site locally and internationally
- preparing an iN-Site platform for european students exchange
- preparing a Final Conference for students presentation the most relevant awareness recommendations produced by iN-Site.

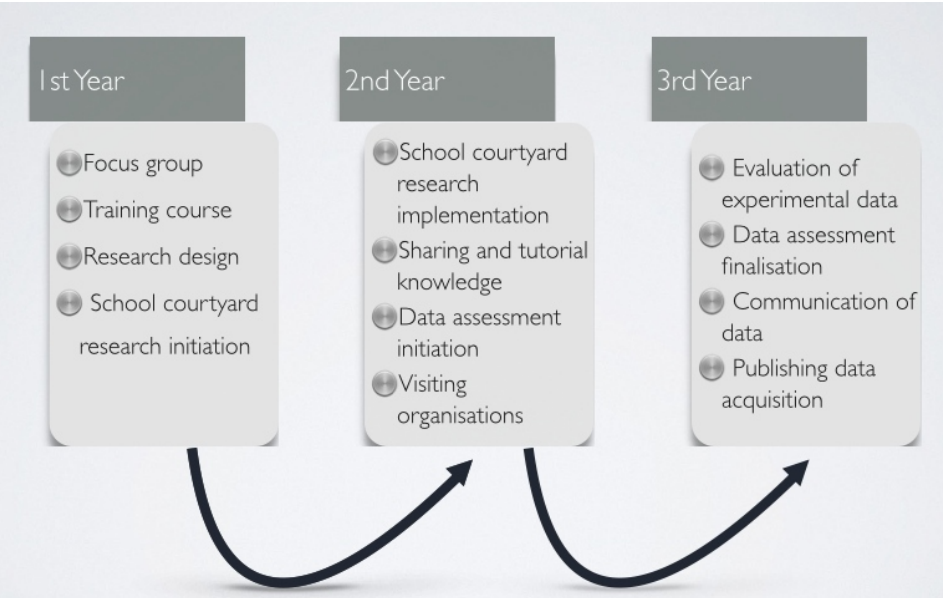
7.2. Communication activities

During the implementation of the program students, with the help of their teachers and research mentors, will be invited to develop different communication strategies as press releases, exhibitions at school, role-plays, media and radio. The most important strategy behind these communication activities is to teach students different communication methods according to the focused audience. This will be adapted to the reality of each country but the main target is to involve young students in different approaches to support active citizenship. Being the N an "issue", well thought-through messages and tools will make accessible to a wide range of audiences. Similarly, the further development of tools, such as the "N toolkit", can help the communication and message dissemination of N-relevant knowledge.

8. Work Plan - Work packages, deliverables and milestones

8.1. Overall structure

The first year of the project will involve developing the public consultation (WP2), a professional teacher development (WP4), the establishment of an experimental research at school courtyards (WP5) and the launch of website (WP7).



The work progress

Discussions will be held about public consultation, using the focus group methodologies, course structure, research design and how this research can be adapted to different country conditions, taking into consideration school differences (WP3 Levelling). The ***focus group*** is a qualitative research method, very flexible that was even applied to follow food choices of students (Neumark-Sztainer, Story et al. 1999). The first consortium meeting (WP1) will also focus on training participants on this educational methodology. The public consultation will be used as a background knowledge of views, values and attitudes of teachers, from different disciplines within a school area, about their perceptions of N risks. The data collected will serve teachers, as players in learning process, to implement a program development, within the scholar curriculum, to help secondary school students to acquire an integrate scientific knowledge on the meaning of N sustainability. A broad view of teacher knowledge within parts of Europe is also achieved as part of a iN-Site outcome.

The public consultation will be done during the first two to three months of the project in all countries, in order to construct the previous knowledge profile of teachers on N benefits and threats. The focus group will be run and moderate by researchers, following a general preparation at the kick-off meeting. Questions and points of discussion will be the same in all countries in order to have a further data comparison. This data collection will provide a useful resource to further develop iN-Site communication resources and strategies and to think about how best (or how not) to present it to students and to manage media interface.

The previous experiment in INQUIRE project of some participants of iN-Site consortium showed that inquiry-base science education (IBSE) is the best method to have teachers involved and making part of learning communities (Martins-Loução, Gaio-Oliveira et al. 2013). Having in mind the concept of ***teachers' professional development***, iN-Site will develop a 3 months refreshing course for secondary education level on IBSE. For this course, researchers shall also be invited to follow, since this pedagogic method is not common in higher education systems (Savery 2006)(Buck, Bretz et al. 2008).

The course will be designed to run during 3 months aiming at: (i) teacher's refreshment of IBSE methods; (ii) encourage a reflective practice of teachers and researchers own learning and practices; (iii) give support to teaching staff give more

space to the students work; (iv) reinforce the need of approaching students with problems-based learning to promote their own investigation. This course also benefits the link between teachers and researchers, crucial to establish a further teacher-researcher mentorship to work with students.

Science education innovation means also interdisciplinary practices to promote a full interaction at school. The interdisciplinary interaction of disciplines within school and the link of school with higher education institutions is the major issue of this professional development program. This interaction will create a culture of permanent evaluation that will constitute the basis for internal adaptations and reorganisations whenever needed. In detail, the teachers and researchers tutorial interplay will include the following modes and practices of action, during the iN-Site project.

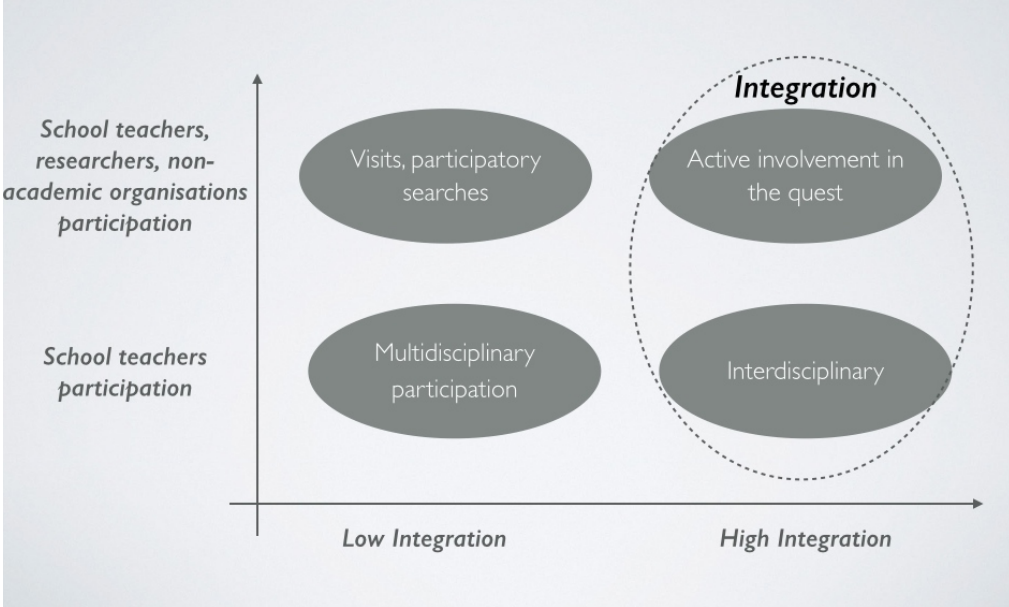
Period (months)	Modes of action	Practices
4 - 7	Course	Training IBSE
6 - 12	Sharing	Supporting, stimulating
12 - 36	Tutorial	Modelling, demonstrating
6 , 12, 24	Regulation	Internal adaptation and reorganisation

The experimental testing at school will depend on school facilities. School courtyards have generally superb locations for experimental research designs. They may contain diverse collections of plants or even wild plots that can be reconverted in experimental plots. Mostly situated in urban areas they are accessible places that can offer stimulating experiments for students to gain first hand contextual experiences in RRI. iN-Site ***research development*** will focus on a wide, but simple, variety of investigative work with plants, fertilisers and soil. Utilising a problem-base solving experiment to motivate students between 16-18 years is the best to achieve students engagement with research. All the details will be discussed on the 1st consortium meeting in order to arrange a common situation in each country.

Researchers will support school-based infrastructures facilities to establish a tutorial network between teachers and their students. Each school will be free to develop their own experimental design according to their possibilities.

The second year of the project will see the ***implementation of the research***

(WP6) initiated on the first year and the generation of a responsible science knowledge on secondary school students achieved with a cross-cutting trans-disciplinary interaction. The focus is not only on the preservation of the quality and diversity of knowledge, but on the flow and exchange of knowledge between those embedded in the same scientific culture (Mauser, Klepper et al. 2013). Thus, trans-disciplinary interaction will be established with high integration and involving different disciplines in school, tutorial work by researchers, and the contact with representatives of parents association, food and environmental organisations.



The view of trans-disciplinary integration

During the project framework the following strategy of modes and practices of action will be follow, always with an interactive link between school and research institutions.

Period (months)	Modes of action	Practices
6 - 12	Tutorial experiences	Experimental testing at school
12 - 20	Tutorial collection	Evaluation of traditional diets at the region, family diet traditions
18 - 36	Mentoring exploitation	Food regulations, environmental laws, open-access data, online exercises
22 - 36	Mentoring development	N - toolkit development, footprints calculations

These interactions will offer new opportunities for young students: (i) to entail various degrees of science integration and experimentation; (ii) to build trust and confidence in scientific institutions, which is crucial for creating the appropriate attitude to tackle societal problems; (iii) to produce new and insightful knowledge and solutions for planned changes towards a responsible and socially inclusive science.

The mentoring research plan will be implemented along the time through on line exercises and researcher' visits to schools. Students will also be able to visit research labs and other institutions directly connected with N industry and food production. Data and problems within the implementation of this trans-disciplinary interaction will be discussed and adjusted during the 3rd Consortium meeting. Data compilation will be discussed at the 4th Meeting.

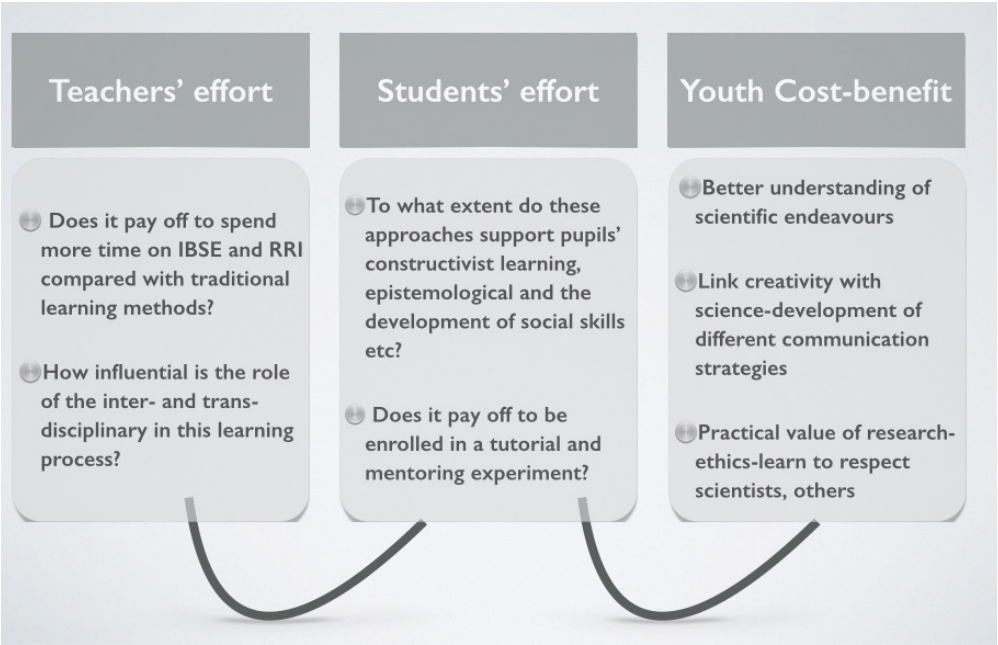
The third year of the project will see student Partners finishing and consolidating the data collected. The development of iN-Site research program includes the acquisition of detailed data for students to fill identified and unidentified scientific knowledge gaps, through an open-access online resource platform. Besides hands-on training experiments students will also be trained to a peer review opportunity stimulated by student's group interactions and researcher's mentorship, within and outside countries. Equally, the interpersonal interactions with researchers, colleagues, other non-academic people, and families are input data that will give opportunities to create an overall analysis of society problems and views, inputing in ***the online platform***. The online interaction with researchers will allow students to reflect on their competencies and in gaining confidence in using and testing online scientific models. Together, the online exercises will help student's built technological skills, that could be leveraged in further careers searches.

A detailed understanding of the social system brought by the direct contact with non-academic institutions and families will be useful for determining simple messages communication and ways of adapting to on-the-ground realities, audiences, and constraints. Familiarity with local meanings and influential parts of the social system provides discrete opportunities for those involved in planning to improve their communication (Hall, Lazarus et al. 2014).

With the help of their teachers and mentor researchers, students will be able to develop different ***models of communication*** to disseminate the relevant in-

formation on school courtyards and on society in general. Particularly, students will be taught about how to influence the public domain, and how to develop messages to be successfully communicated. This includes online news, radio messages, role-plays and an educational resource, the N-toolkit, to interact with other students, out of the project, to test various aspects of nitrogen threats. The N-toolkit, an e-resource, focussed on the nitrogen challenge will make use of emerging technologies and delivery platforms (such as iPads or other tablets) to approach and enrol more people in N message. Through these online resources, press releases, audiences, radio or school journals, the students make a creative link between science and society promoting the culture of a knowledge-based society. At the end of the project students are able to attend the final conference where they can present their data and learn from others the reality of other countries.

Quality of the project (WP8) is assured by the partner KCl who will support partners to achieve high quality standards agreed upon. iN-Site will engage teachers and researchers to examine how this trans-disciplinary program can be implemented across multiple classrooms throughout Europe. iN-Site will encourage teachers and particularly school boards to approach ***quality standards***.



The approach for the quality standards

Classroom based research not only helps practitioners to reflect on their own practice but helps them to modify their own teaching sustainably (McLaughlin,

Blackhawkins et al. 2006). Supported by King´s College, London, teachers and researchers in 6 European countries will engage in reflective practice to learn how resources can be adapted and whether this adaptation will influence how students develop their critical thinking skills and scientific practices.

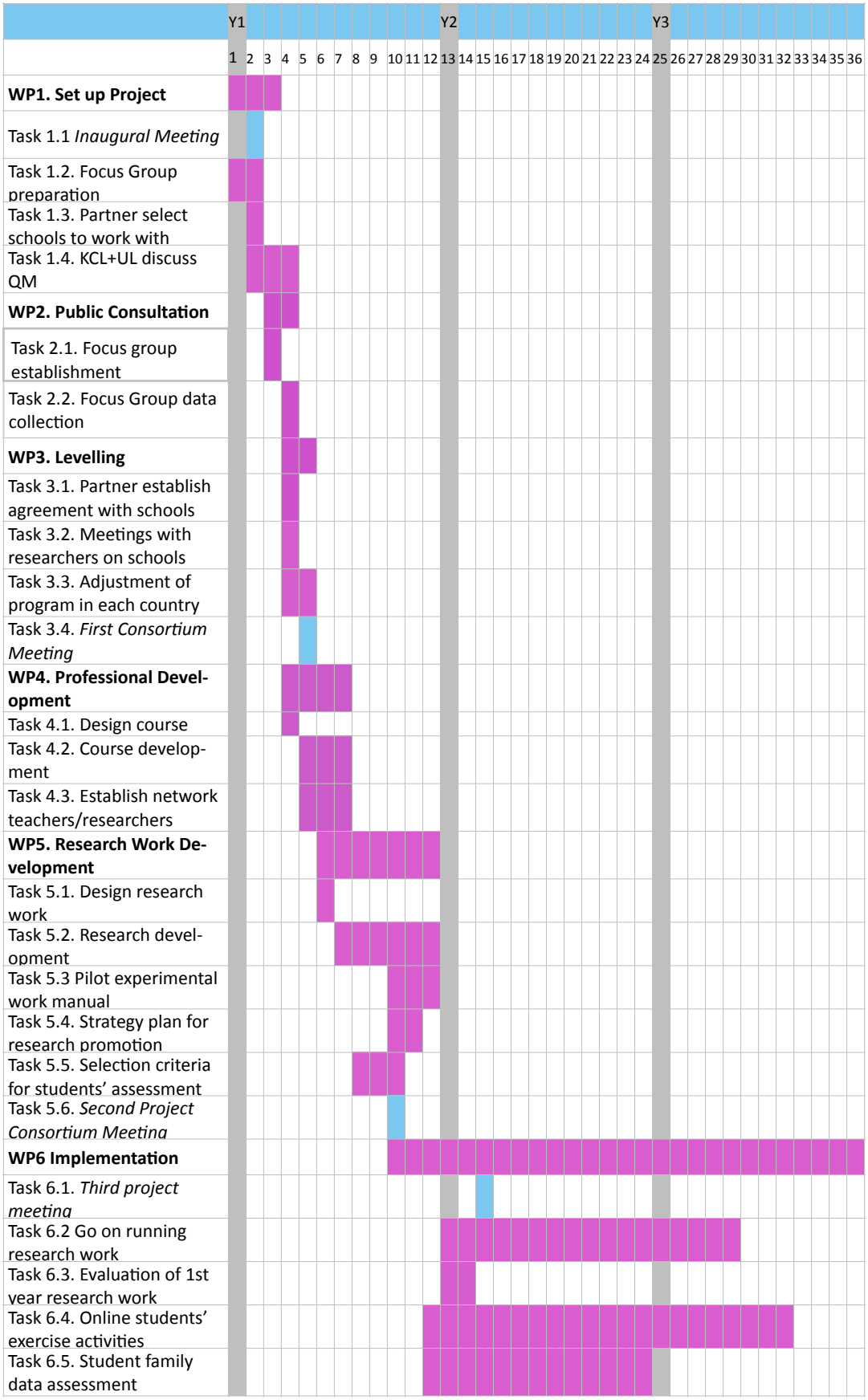
8.2. Work plan, Work packages and their components

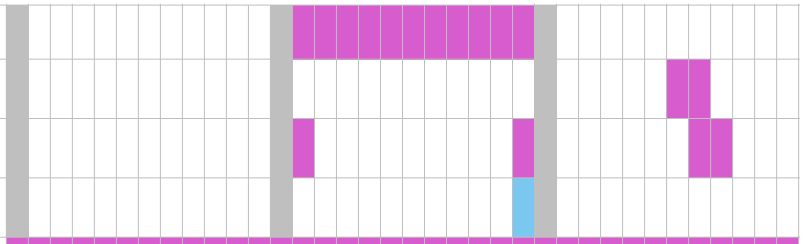
iN-Site focuses on supporting activities to raise student's awareness of the different aspects encompassing science and technology of nitrogen (N) in biosphere in their societal content. To reach this outcome iN-Site foster a sustainable and cross-cutting interaction between the different levels of the education system, research and school institutions.

The refreshing course on IBSE and the research development will be supported and monitored by partners LFU and VU (Research management) that will help to improve the course and research development design while work is in progress. The project is structured within nine work packages with four in consecutive phases. Each phase is characterised by one work package. Four work packages span the whole project duration. An external evaluation is planned.

Work Package	WP-number	WP-Leader	Duration
Set up the project	WP1	UL	Month 1-3
Public consultation	WP2	UL	Month 2-3
Levelling	WP3	UL	Month 4-5
Professional Development	WP4	LFU	Month 4-7
Research Development	WP5	VU	Month 6-12
Implementation	WP6	UPM	Month 10-36
Dissemination and Communication	WP7	CEH	Month 1-36
Quality Management	WP8	KCL	Month 1-36
Project Management	WP9	UL	Month 1-36

Timing of Work packages



Task 6.6. Student interaction with CSO	
Task 6.7. Evaluation of second year research work	
Task 6.8. Evaluation of students' data collection	
Task 6.9. *Fourth project meeting*	
WP7. Dissemination and Communication	
Task 7.1. Communication in schools	
Task 7.2. Inform other schools	
Task 7.3. Train student communication skills	
Task 7.4. Development of N-toolkit	
Task 7.5. Students' communication events	
Task 7.6. Press release national	
Task 7.7. Press release international	
Task 7.8. iN-Site N assessment	
Task 7.9. iN-Site Platform	
Task 7.10. iN-Site website: launch and update	
Task 7.11. Link students via website	
Task 7.12. Final Conference	
WP8 . Quality Manage-	
Task 8.1. QM plan	
Task 8.2. Implementing QM	
Task 8.2. Report performance	
WP9. Project Management	
Task 9.1. Prepare and run inaugural meeting	
Task 9.2. Meetings organisation	
Task 9.3. Internal and External Reporting	
Task 9.4. Finantial administration	
Task 9.5. Project coordination	
Task 9.6. External evaluation	

Detailed work description

Work package number	1			Start date or starting event: 1				
Work package title	Set up Project							
Participant number	1	2	3	4	5	6	7	
Participant short name	UL	KCl	CEH	LFU	VU	UPM	EMUNI	
Person-months per participant:	12	6	6	6	6	6	6	

Objectives:

- Achieve a high degree of work quality with all participants, addressing formal requirements in an effective, timely and responsible manner.

Description of work:

This work package is dedicated to setting up the project. All partners will meet for the first time to discuss and agree on project structure and characteristics.

Work comprises the following tasks:

Task 1.1 Inaugural meeting: This meeting will take place at the University of Lisbon, Portugal. The project consortium will meet for the first time, providing opportunity for partners get together. Based on draft versions prepared by the Management Board, the consortium will work on a detailed project-structure, establish deadlines, define a research framework, meeting schedule etc. A training session will be organised to train partners on focus group. This meeting will last two days (two nights) and will be essential for a smooth and effective project progression.

Task 1.2. Focus group preparation. iN-Site will prepare the layout of focus group to be implemented in each country with school teachers.

Task 1.3. Partners select schools to work with in each participating country. School selection are presented at the first meeting.

Task 1.4. KCL and UL will discuss the draft version of a "Quality Assurance Manual" with partners during the Inaugural meeting. The version will be developed further based on these talks and previous discussions with school teachers. Partners will provide ideas and individual local and regional circumstances to be considered.

Deliverables :

Deliverable 1.1.: Project Planning (month 3)
Deliverable 1.2.: Preliminar quality manual (month 3)
Deliverable 1.3.: Criteria for Focus Group establishment (month 3)

Milestones :
Inaugural meeting of the iN-Site project

Work package number	**2**			**Start date or starting event: 3**			
Work package title	**Public Consultation**						
Participant number	**1**	**2**	**3**	**4**	**5**	**6**	**7**	
Participant short name	UL	KCl	CEH	LFU	VU	UPM	EMUNI	
Person-months per participant:	12	6	6	6	6	6	6	

Objectives:
- Focus group establishment in each country
- N Risk assessment data for each country
- Collection of data on countries views on N risks and societal challenges

Description of work:
This work package is dedicated to make a public consultation about N risk views in each country.

Work comprises the following tasks:

Task 2.1 Focus group establishment: After the training at the inaugural meeting and the plan session of questions that should be rise each partner performs at least 3 different focus group with different school teachers and school board members. These focus groups shall be performed during the month 3 to 4.

Task 2.2. Focus group data collection. At the end of focus group all data are collected and sent to project management that will be discussed with quality management board.

Deliverables :
Deliverable 2.1.: Social N risk views from 6 different countries (month 4)

Milestones :
Acquisition of knowledge on the range of factors that limit school board teachers to understand N threats, in the different european countries (month 4).

Work package number	**3**			**Start date or starting event: 4**				
Work package title	**Levelling**							
Participant number	**1**	**2**	**3**	**4**	**5**	**6**	**7**	
Participant short name	UL	KCl	CEH	LFU	VU	UPM	EMUNI	
Person-months per participant:	12	6	6	7	7	6	6	

Objectives:

- To have a share understanding on the refreshing teacher course on IBSE to be offered in each country
- To acquire the essential knowledge to accomplish the iN-Site research development and tutorial work

Description of work:

This Work package is dedicated to developing a shared understanding of what attributes are characteristic of inquiry based science education for iN-Site teachers course. Partners will all participate in this process to develop a shared understanding.

The involvement of partners on research development design about N effects on environment is also discussed, facing the data obtained about the range of factors that can limit students understanding on N threats. This WP is also dedicated to the understanding of tutorial students work and school/research institutions network. It will be discussed the meaning of students tutorial and mentoring on practical terms.

Work comprises the following tasks:

Task 3.1 Partner establish agreement with schools: Each partner will select a partner school with whom they will work.

Task 3.2. Meeting with researchers with school boards and teachers: Researchers will establish a scholar program with school boards and teachers to fulfil iN-Site objectives.

Task 3.3. Adjust of program in each country: together with teachers, researchers will adapt the research program to secondary school students, according with the educational curriculum.

Task 3.4. First consortium meeting (month 5). This meeting will focus mainly on developing a shared understanding of inquiry based science education applied to secondary school teachers. Discussion of the different design course proposals brought by each partner. Action minutes of the first consortium meeting will summarise shared understanding on the meaning of RRI and what actions shall be promoted to establish a true trans-disciplinary network for the benefits of students N science knowledge.

Deliverables :

Deliverable 3.1.: iN-Site teachers' course program (month 5)

Deliverable 3.2.: iN-Site characterisation of trans-disciplinary integration and RRI (month 5)

Milestones : Normalisation of criteria for trans-disciplinary research work implementation with secondary school students in each country (month 5).

Work package number	4			**Start date or starting event: 4**			
Work package title	**Professional Development**						
Participant number	**1**	**2**	**3**	**4**	**5**	**6**	**7**	
Participant short name	UL	KCl	CEH	LFU	VU	UPM	EMUNI	
Person-months per participant:	10	9	8	12	9	8	8	

Objectives:
- Development of teacher/researcher course on IBSE
- Establishment of the network teacher/researcher at school level

Description of work:
This Work package is dedicated to developing the refreshing course on IBSE methods focused on teachers and researchers. This is an instrumental course to able teachers and researchers for promoting science motivation and investigation on secondary school students. Teachers from different disciplines will attend the course as well as researchers. The presence of both educational and research practitioners will favour the establishment of an efective network between teachers and researchers.

Work comprises the following tasks:

Task 4.1 Design the course: Each partner will propose a design course plan to be discussed in the first consortium meeting.

Task 4.2. Course development: Month 5-7 will focus on developing the course on IBSE. A detailed structure about goals, tasks and expected outcomes will be discussed

Task 4.3. Establish network between researchers and teachers**:** together with teachers, school board teachers and researchers a network will be established for the implementation of iN-Site program. A tutorial and mentoring program will be defined in each country partner, presented and discussed with parents association of each school.

Deliverables :
Deliverable 4.1.: Educational materials identification on N for further inclusion in supporting students' research (month 7).
Deliverable 4.2.: School/Research Institution agreement for the establishment of students research commitment (month 7).
Deliverable 4.3.: School/ Research Institution and Parents Association commitment to support students involvement (month 7).

Milestones :
Establishment of a scientific network between secondary schools and research institutions towards a cross-cutting trans-disciplinary integration to motivate students for science and N threats awareness (month 5).

Work package number	5			**Start date or starting event: 6**			
Work package title	**Research work development**						
Participant number	**1**	**2**	**3**	**4**	**5**	**6**	**7**	
Participant short name	UL	KCl	CEH	LFU	VU	UPM	EMUNI	
Person-months per participant:	10	8	10	8	12	8	8	

Objectives:
- Development of iN-Site research program at schools

Description of work:
This Work package is dedicated to developing the pilot iN-Site research program at school courtyards, according with problem-based learning and following scientific methods. Existing N educational resources (N footprint, online problems, video games, etc) will be examined and organised between teachers and researchers before presenting to the students.

Work comprises the following tasks:

Task 5.1 Design research work: Month 6 will focus on the discussion with students about the best design for the research work they will carry on at the school courtyard. Students will be responsible for this design with the tutorial work of researchers.

Task 5.2. Research development: Month 7-12 will focus on developing the research modules and to establish the tasks to be carried out by each group of students.

Task 5.3. Pilot experimental work manual. Each students team will write a preliminar research manual with the help of their teachers and the tutorial support of researchers. This manual will include research design, planning, theoretical background, and will serve further experiments in school (month 10).

Task 5.4. Strategy plan for research promotion. Each student team will write a preliminar plan for promoting the school experiments and the involved research. At the end of this period (month 10) one plan will be disseminated.

Task 5.5. Selection criteria for student's assessment. Teachers and researchers will discuss on the best criteria to assess students' involvement on this research program. This will be adapted at each school country level (month 9-10)

Task 5.6. Second project consortium meeting (month 10). This meeting will focus mainly on discussing the first pilot experimental work manual presented by each partner, strategy plan for research promotion and selection criteria for students' assessment.

Deliverables :
Deliverable 5.1.: Pilot iN-Site research manual (month 12)
Deliverable 5.2.: Strategic plan for research promotion at national level (month 10)

Milestones :
Establishment of a research experimental plot on N effects at school courtyards (month 10)

Work package number	6			**Start date or starting event: 10**			
Work package title	**Implementation of research work**						
Participant number	**1**	**2**	**3**	**4**	**5**	**6**	**7**	
Participant short name	UL	KCl	CEH	LFU	VU	UPM	EMUNI	
Person-months per participant:	10	8	10	8	12	8	8	

Objectives:
- Development of iN-Site research implementation at schools
- Development of trans-disciplinary integration on students learning

Description of work:
This Work package is dedicated to implement and go on running the iN-Site research program at school courtyards. iN-Site will enlarge research involvement with students, using online tutorial work together with visits and searches to food and environmental organisations, families involvement on assessing diet traditions. The tutorial work of researchers will be assured through online contacts and semestral visits to school. Mentoring for students data collection will be organised between teachers and researchers.

Work comprises the following tasks:

Task 6.1. Third project consortium meeting (month 15).: This meeting will focus on discussion the partners experiences and problems while running the research experiments at schools. It will also be used to discuss dissemination and communication tools developed by each partner.

Task 6.2. Go on running research work: Month 12 will focus on following the research modules carried out by each group of students.

Task 6.3. Evaluation of 1st year research work. Each students team will collect and analyse data after the 1st year research experiment. This will be done with tutorial work of researchers and support of teachers (month 13-14).

Task 6.4. Online students' exercises. Each student team will follow online research activities proposed by researchers (month 11-33).

Task 6.5. Students family data assessment. Researchers will mentor students' work on assess diet family traditions (month 11-24)

Task 6.6. Students interactions with CSO. Researchers will mentor students' interactions with civic society organisations concerning N issues (month 14-24).

Task 6.7. Evaluation of 2nd year research work. Each students team will collect and analyse data after the 2nd year research experiment. This will be done with tutorial work of researchers and support of teachers (month 30-31). Compilation of all data will be done.

Task 6.8. Evaluation of students data collection. Researchers will evaluate the data collected during research experiment as well as online exercises and all collected evidences the students have organised. Researcher will mentor the students for a full understanding on the meaning of collected data on N threats.

Task 6.9. Fourth project meeting (month 24). This meeting will focus on discussion the partners data collection and further construction of publications and iN-Site final assessment.

Deliverables :
Deliverable 6.1.: N effects on biodiversity at different countries (month 36).
Deliverable 6.2.: Traditional familiar diets at each partner country (month 36).

Milestones :
Compilation of data for the iN-Site final assessment (month 36)

Work package number	7			**Start date or starting event: 1**			
Work package title	**Dissemination and Communication**						
Participant number	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Participant short name	UL	KCl	CEH	LFU	VU	UPM	EMUNI
Person-months per participant:	10	8	16	8	10	8	8

Objectives:
- Reach a high people awareness about project goals and activities
- Development of students skills to communicate N issues
- Development of educational resources to communicate N issues

Description of work:
Dissemination activities will focus on sharing information and knowledge between partners and society. Communication activities will focus on developing students skills so that all students are capable of handling complex messages in simple ways but still knowledge-base manner.

Work comprises the following tasks:

Task 7.1. Communication in schools.: Dissemination in schools where the project is running is focused on inform and involve all school teachers and non-teachers staff in the project. The researchers and the direct teachers involved will be in charge of this communication at school level.

Task 7.2. Inform other schools: Periodically students and teachers will contact other schools to disseminate the iN-Site activities and involve them through project website.

Task 7.3. Train students communication skills. Training modules on communication and different strategies of science communication will be promoted by researchers to develop particular students' training sessions at school (month 14-16).

Task 7.4. Development of N-toolkit. Students will develop an online educational resource to facilitate the communication of N issues to other young students. This will be done with research mentorship (month 26-30).

Task 7.5. Students communication events. Students will promote different communication events to spread awareness on N issues.

Task 7.6. Press release national. CEH will produce press releases during the project. These will be translated by partners into their languages and distributed through their networks at country level. CEH will maintain a database of press contacts.

Task 7.6. Press release national. CEH will produce press releases during the project. These will be translated by partners into their languages and distributed through their networks at country level. CEH will maintain a database of press contacts.

Task 7.7. Press release international. iN-Site Information leaflets will be produced and translated into the other 5 different languages and also in arab to be spread in all Mediterranean region by EMUNI. Partners will distribute this leaflet. CEH will promote the iN-Site activities to networks of research institutions. This will include international organisations such as IUCN-The International Union for Conservation and Natural Resources, UNESCO, UNEP, etc.

Task 7.8. iN-Site awareness recommendations. CEH will use all the information input by each partner work on iN-Site platform to produce a final technical document for academic researchers across a wide range of disciplines, stakeholders and policy makers in Europe and South Mediterranean region. These recommendations intend to be an important communication tool for awareness of N and societal challenges. It will use all data compiled within project by students by providing succinct messages that represent the pros and cons of nitrogen and possible societal choices Europe could do. iN-Site Recommendations will be launched at the final conference and will involve students participation and communication with press.

Task 7.9. iN-Site Platform. A central information provider will be launched by CEH. All data acquired by students during their experimental research and bibliographic searches will be uploaded and maintained in this platform for all partners consultation. CEH will be responsible to sum up all the most relevant information to be used for the iN-Site assessment.

Task 7.10. iN-Site Website. The iN-Site website will be launched in month 4. It will be translated into 5 European languages, plus arab and updated on a regular basis to enable students to interact with each other and to exchange knowledge and experiences gained while participating in the iN-Site activities. CEH will maintain the English area of the website and partners will update their own language areas in collaboration with CEH. A three hour training session will be run at the first consortium meeting to train partners in uploading information to the website. The website will contain a range of materials including downloadable resources, links to relevant websites, training videos, images and news items. There will also be a section members only for partners. All manual and data research will also be uploaded onto the website in month 36.

Task 7.11. Link Students via website. This link will establish students' contact on an international basis. CEH will create a list serve, linked to the iN-Site website, for students to post questions, exercises and contact each other. The international list serve will be in English. Following discussion with partners, CEH may create different list serves for each language.

Task 7.12. Final Conference. UL will organise the Final Conference in Portugal. The conference will be in English and will run over two days. It will take place in month 32. Approximately 200 attendees from the 6 countries are envisaged to attend the conference including, students, teachers, researchers and decision makers.

Milestones :
7.1. Website launch (month 4)
7.2. Final Conference and assessment of iN-Site (month 32)

Work package number	8			**Start date or starting event: 1**				
Work package title	**Quality management**							
Participant number	**1**	**2**	**3**	**4**	**5**	**6**	**7**	
Participant short name	UL	KCl	CEH	LFU	VU	UPM	EMUNI	
Person-months per participant:	10	12	6	6	6	6	6	

Objectives:
- Achieve a high degree of work quality with all participants, addressing formal requirements in an effective, timely and responsible manner.

Description of work:
Quality Management Team (QMT) will mainly focus on the evaluation processes carried out during the iN-Site research development by students. Partner KCL (teachers support), UL and VU (formative and summative assessment of students development) will develop a Quality Management Plan to support researchers and teachers in all 6 participating countries to come up with reliable and comparable research outcomes.
For teachers reflective practice, iN-Site will draw on research in investigative science, argumentation, attitudes to science, interest and motivation, use of external partners and facilities (e.g. research centres, university labs).

For summative and formative student development, iN-Site will offer support on research in student work assessment, students scientific knowledge, students training communication skills, and data obtained from indoor (school) experiments and data search.

Work comprises the following tasks:

Task 8.1. Implementing quality management plan.: Development, implementation, communication and maintenance of an agreed Quality Management Plan (incl. formative and summative student assessment framework). A draft version (discussion points) will be developed at the beginning of the project and will be discussed during the Inaugural Meeting. Partners will agree on the detailed Quality Management Plan within the first 4 months. This plan will include formative and summative assessment of students participation on research experiments, data search, research attitudes and communication events. Helpful interaction with all responsible partners and project teams, concerning activities (KCL and VU will visit each partner at least once). In addition the QM will use consortium meetings to support partners in fulfilling their tasks.

Task 8.2. Report performance: Partners will report to the QM on a regular basis (reporting time will be listed in the Quality Management Plan) informing the team about difficulties, success, outcomes etc..

Deliverables :
Deliverable 8.1.: Quality Management Plan (month 12)
Deliverable 8.2.: Final Quality Management Report (month 36)

Milestones :
Homogeneous assessment of students during iN-Site project (month 36)

Work package number	9			**Start date or starting event: 1**				
Work package title	**Project Management**							
Participant number	**1**	**2**	**3**	**4**	**5**	**6**	**7**	
Participant short name	UL	KCl	CEH	LFU	VU	UPM	EMUNI	
Person-months per participant:	20	4	4	4	4	4	4	

Objectives:
- Ensure optimal use of resources (human and other) available for the project.
- Ensure timely execution of all project relevant activities
- Ensure smooth and effective communication and integration between all partners
- Internal assessment of the work done during the project

Description of work:
The iN-Site Management Board is responsible for the day to day operation of the project to ensure that project milestones are reached within the proposed time and agreed upon deliverables are issued in a timely manner as well as in high quality. The managerial responsibility is assumed by the project coordinator (UL).
Work comprises the following tasks:

Task 9.1. Prepare and run inaugural meeting.: Focuses on preparing the Inaugural Meeting as well as developing a detailed project structure. In this meeting the Management Board will draft a "Project Planning document" a "Dissemination Plan", a "Quality Assurance Manual". Draft versions and discussion points will be sent to partners prior to the Inaugural Meeting so they can prepare for the discussions during the meeting. This will speed up the process.

Task 9.2. Meetings organisation: PM is responsible for all meetings organisation and preparation, giving support of different host meetings (agenda, venue, minutes).

Task 9.3.Internal and external reporting

Task 9.4. Financial administration

Task 9.5. Project coordination: is focusing on a timely completion of planed WP deliverables (harmonic relationship between participants contributing to the WP) as well as the financial administration of the project. The coordinator is also responsible for handing in reports to the EU commission on time (reporting period. 18 month, reporting date month 18 and 36). Together with WP leaders the coordinator is responsible for quality control of WP outcomes.

Task 9.6. External evaluation: UL will be responsible for providing all necessary information needed to support the External Evaluator carrying out his work.

Deliverables :
Deliverable 9.1.: Interims External Evaluation Report (month 24)
Deliverable 9.2.: Recommendations from Consortium Meetings (month 12,24,36)
Deliverable 9.3. Final external evaluation report (month 36)

Milestones :
iN-Site manuals (research and communication) published on website (month 36)

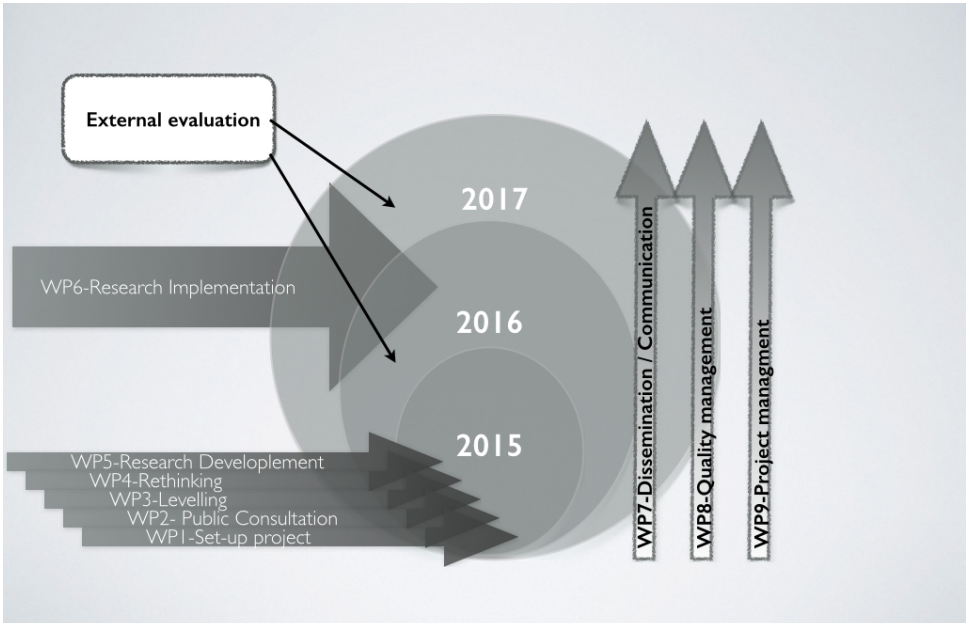
List of deliverables

Del no.	Deliverable name	WP	Delivery month
1.1.	Project planning	1	4
1.2	Preliminar quality manual	1	4
1.3	Criteria for Focus group establishment	1	3
2.1	Social N risks views in 6 countries	2	4
3.1	iN-Site teacher course program	3	5
3.2	iN-Site characterisation of trans-disciplinary integration and RRI	3	5
4.1	Educational materials identification on N	4	7
4.2	School/research institutions agreement for the establishment of students research commitment	4	7
4.3	School/research institutions and Parents Association commitment to support students involvement	4	7
5.1	Pilot iN-Site research manual	5	12
5.2	Strategic plan for research promotion at national level	5	10
6.1	N effects on biodiversity at different european countries	6	36
6.2	Traditional familiar diets survey at each partner country	6	36
7.1	Dissemination plan (national + international)	7	4
7.2	iN-Site information leaflet in 7 languages	7	13
7.3	iN-Site awareness recommendations	7	32
7.4	Final N-Toolkit	7	36
7.5	iN-Site Platform	7	13
8.1	Quality management plan	8	36
8.2	Final quality management report	8	36
9.1	Interims external evaluation report	9	24
9.2	Recommendations from consortium meetings	9	12, 24,36
9.3	Final external evaluation report	9	36

List of milestones

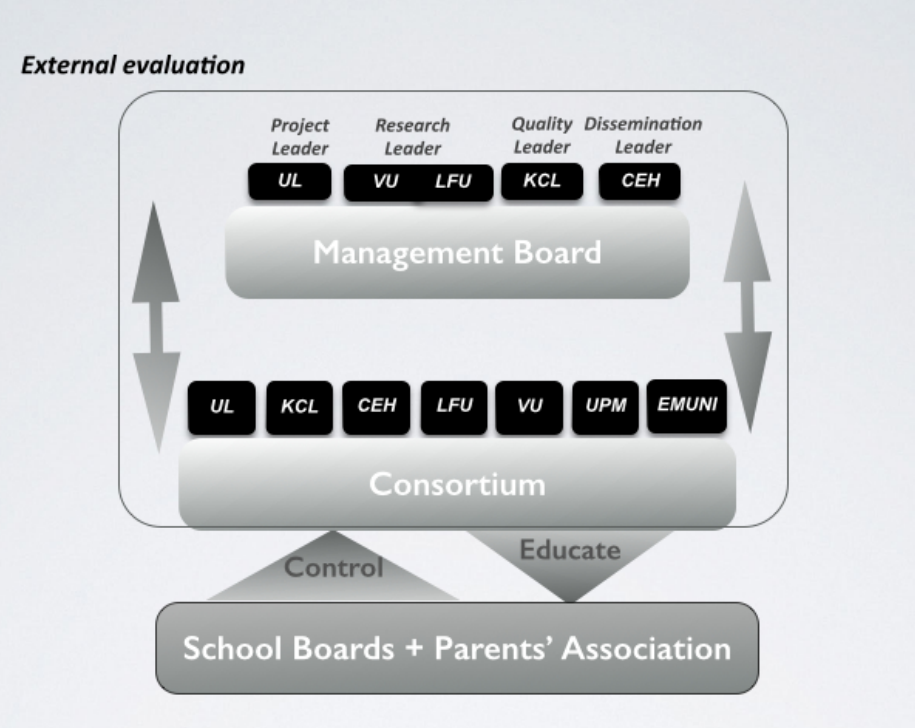
Milestones number	Milestone name	WP involved	Expected date
1	Inaugural meeting	WP1	Month 2
2	Acquisition of factors that limit understand of N threats, in european countries	WP2	Month 4
3	Website launch	WP7	Month 4
3	Criteria for trans-disciplinary research work implementation	WP3	Month 5
4	Scientific network between secondary schools and research institutions	WP4	Month 5
5	Research experimental plot on N effects at school courtyards.	WP5	Month 10
6	Final Conference and assessment of iN-Site	WP7	Month 32
7	Compilation of data for the iN-Site final assessment	WP6	Month 36
8	Quality assessment of students	WP8	Month 36
9	iN-Site manuals (research and communication) published on website	WP9	Month 36

Pert diagram



9. Management structure and procedures

The project structure is kept as simple as possible. A number of partners will be allocated the same workload to make supervising and monitoring the project progress accomplishable. This will also make it easier for the Management Board to identify delays in the sense that partners will operate more or less independently and so delays will be limited to a particular partner.



Management structure

The management structure of the project will be based on three formal groups (Management Board, iN-Site Consortium, School-board+Parents' Association, that function as a kind of Advisory Board). The iN-Site Consortium will summarise all representative from each participating country. It will meet on a regular basis (5 Consortium Meetings, an Inaugural Meeting and a Final Conference). In each country an Advisory Groups (teachers, school board, and parents' association) is installed and work in straight line with the consortium. It is this Advisory Board that is responsible for the school/research institution interaction, the adaptation of the project with the curriculum and the monitoring of students' grades.

The ***Management Board*** (MB) is the operational structure of the project, and is responsible for supporting project on a daily basis. The MB is responsible for the overall support of the coordination activities, as well as horizontal functions that apply to several areas for which coordination activities are carried out. The central support function is continuously developed over time in accordance with experience gained from the co-operation.

The main tasks and responsibilities of the MB are:

• project decisions in the field of project results, procedures, activities to be carried out and support for partners to fulfil iN-Site quality standard agreed in the consortium agreement.

• to interact with the iN-Site Consortium for guidance and advice with respect to the goals and activities of the project, for instance to ensure a basis for the project results.

The Management Board meets mainly during Consortium Meeting sessions. One additional meeting is planned to prepare the Inaugural Meeting. This meeting is planned to be organised as video conference.

The ***Quality Management Team*** is responsible for ensuring that the project meets the iN-Site objectives and that resources are used effectively. The Quality Manager (KCL) will facilitate a clear systematic approach for achieving goals. Partners will be aware of existing research. Practitioners will report on progress to the Quality Manager on a regular basis. The Quality Manager will support a coherent approach, launching a first students' assessment criteria (month 3) but only at end the final quality management will be launched (month 36). The first manual will consist of:

(i) A " Teachers/Researchers manual" for iN-Site course participants will include guidelines on how to structure and run reflective practice while implementing the research development.

(ii) A "Summative and Formative Evaluation Framework", to evaluate the process of student development during the project.

QM helps to organize consortium meetings. It is also responsible to evaluate outcomes of these meetings and checking reports from the quality point of view. KCL will visit each participating partner once to discuss local circumstances. The final Quality Management Report (Month 36) will include best practice models by the end of the

project and will include formative and summative evaluation results. This Report is published on the iN-Site website to support new similar projects all over the world.

The ***Research Management*** (RM) is hosted by VU and LFU. The RM will be responsible for the development of course and research program organisation. They are also responsible for the search of educational materials made already available on N and they will support the QM on assessing the teachers and students quality control. They are also responsible for the implementation of trans-disciplinary integration and helping parners in following criteria for this establishment.

The ***Dissemination Management*** (DM) is hosted by CEH. The DM will draft publishable deliverables and will work closely with the Project Coordinator (PC) for final revision before these papers will be sent to the EU Commission and will be released to the public. DM will help to organize consortium meetings and to develop the project handbook (web portal which supports data exchange between project partners), the final N-toolkit and the iN-Site recommendations. The development and the maintenance of both iN-Site website and iN-Site platform will be carried out and the Final Conference will be organised. The DM will be responsible for all dissemination activities described in WP 6.

The ***Project coordination*** is hosted by UL. Coordinators responsibilities include communication and schedule management, coordinating meeting materials and assisting project team by: (i) monitoring and coordinating the development process; (ii) project plan execution and monitoring; (iii) updating the plan of the project; (iv) coordination of the work package leaders; (v) carrying out the operational management of the project; (vi) maintaining contact with and between partners; (vii) reporting to the Consortium; (viii) preparing documents and delivering information needed for the decisions of the iN-Site; (ix) maintaining contact between Management Board members; (x) carrying out correspondence with the EU Commission; (xi) monitoring compliance with legal regulations of the European Community concerning; (xii) control, monitor and report resources and expenditures.

The inaugural meeting (month 2) and the first Consortium Meeting will be crucial to establishing detailed timescales and management structures. In the inaugural meeting participants will agree on a detailed project schedule, deadlines for submitting work, discuss draft versions of “Project Planning, Dissemination Plan, and

the Quality Management Plan" and on the implementation of Public Consultation through the use of Focus Group methodology. Partners will discuss and agree on the procedures that need to be taken if a partner does not meet the required standards and deadlines. The modalities of money transfer will be discussed and agreed upon, keeping various risks in mind. Each partner will provide a Letters of Intent from a regional Teacher Training Institution demonstrating their commitment to support the implementation of the iN-Site in their country. (see work package description).

Consortium Meetings: Consortium Meetings will enable work to be supervised and deadlines checked regularly. In total there will be 5 Consortium Meetings in three Years (a 6th is optional) and each meeting will last 2 days (2 nights including arrival and departure). Partners will be invited to host one of the 5 meetings. The maximum of three people will represent each partner in meetings.

Management Board Meetings will generally be held one day before Consortiums Meetings except the first one which is held in month 1 to prepare the Inaugural Meeting. *Management Board* will be constituted by UL, KCL, CEH and VU. Work package Leaders will not attend this meeting. All other Management Board Meetings will include all management board members. The Management Board will be dedicated to prepare Consortium Meetings and to monitor iN-Site objectives. A final Conference at the end of the project will be held.

Type of Meeting	Year 1	Year 2	Year 3	Total
Management Board Meeting	Month 1 Month 10	Month 15	Month 24 Month 32	5
Consortium Meeting (including inaugural one)	Month 2 Month 5 Month 10	Month 15	Month 24 Month 32	5
Final Conference			Month 32	1

10. Project effort by beneficiaries and work package

Participant	WP1	WP2	WP3	WP4	WP5	WP6	WP7	WP8	WP8	Total p/ month
1. UL	12	12	12	10	10	10	10	10	20	**106**
2. KCl	7	6	6	9	8	8	8	12	4	**68**
3. CEH	6	6	6	8	10	10	16	6	4	**72**
4. LFU	6	6	7	12	8	8	8	6	4	**65**
5. VU	6	6	7	9	12	12	10	6	4	**72**
6. UPM	6	6	6	8	8	8	8	6	4	**60**
7. EMUNI	6	6	6	8	8	8	8	6	4	**60**
Total	**49**	**48**	**50**	**64**	**64**	**64**	**68**	**52**	**44**	**503**

11. Resources to be committed

iN-Site has 36 month project duration and an overall budget of: € 2,249,800 It is divided in personnel costs, travel cost and other costs including conference fees, hosting working meetings and organising the final conference. Money is shared between 7 participating partners in 6 European countries.

Personnel costs are needed to support project partners to install, develop and run the iN-Site research program. In addition, personnel will be needed to organise nationwide school/research meetings, analyse data, summarise and present results. KCl is responsible for supervising summative and formative assessment of students development. VU is responsible for supervising formative assessment of students research.

Travel costs. To establish a good working relationship between partners and to facilitate continuous working progress the consortium will meet on a regular basis. Working sessions will be held in participating countries to help participants get a better understanding of the uniqueness of selected countries.

Other costs. Are mainly focused on dissemination and communication tools.

Expenses for resource material construction, e.g. N-toolkit, or iN-platform will be needed. Also, materials include all the needed material for the implementation of research development at schools. Office supplies, leaflets, organising and conducting the Final Conference are also included in this item.

	UL	KCL	CEH	LFU	VU	UPM	EMUNI	Total
Total person month	106	68	72	65	72	60	60	
Average personnel	3,200	4,900	4,900	4,200	4,900	3,200	3,200	
Total personnel	339,200	333,200	352,800	273,000	352,800	192,000	192,000	
Travel Costs	12,000	8,000	8,000	8,000	10,000	7,000	7,000	
Other Costs	41,000	3,500	3,500	3,500	3,500	7,500	7.500	
Material	17,000	3,500	3,500	3,500	3,500	3,500	3,500	
Costs for translations	4,000					4,000	4,000	
Final Conference	30,000							
Indirect Costs	33,000		71,400					
Website			35,000					
External evaluation	24,000							
e-publications, others	9,000		36,400					
Total	**425,200**	**344,700**	**416,100**	**284,500**	**366,300**	**206,500**	**206,500**	**2,249,800**

12. Significant risks and associated contingency plan

To fully address risk mitigation, the applicants have identified the following risks in the project:

1. A possible delay in the work progress. This risk is medium. The impact of such occurrence is low as the following strategy has been developed: possible deviations from the time plan will be minimised by continuous monitoring of progress, regular planning and analysis of progress per work package, and the analysis of achievement of milestones as well as deliverables. The coordinator is responsible for identifying any negative deviation of the time plan and for taking corrective measures in that case. The inaugural meeting is crucial for setting up and agreeing detailed time schedules and quality standards. In the first consortium meeting the consortium will agree on the modalities of how the funding will be distributed during course of the

project. Payments will be according to work handed in on time.

2. Illness of key staff during a critical phase of the project. This will not be a threat in this project as every partner has more than one person involved in the project who is in charge of exercising the project.

3. Lack of interest by students in the project. This risk is considered low given the involvement of all staff school as well as parents association. Students will be motivated to participate in the iN-Site activities through a range of benefits: (i) joining an european network of students at the same age with an opportunity to communicate and/or visit; (ii) opportunity to develop research skills, data analyses, and communication skills to involve others; (iii) to participate in the Final Conference; (iv) free entrance to visit research labs at national and international level

4. A partners is not succeed in N-toolkit development. This risk is considered low given the high numbers of other students involve in the same kit with whom they can exchange ideas.

Conclusões

"I hear and I forget. I see and I remember. I do and I understand."

The Sayings of Confucius

Esta dissertação assenta em dois trabalhos distintos, mas complementares. Sendo uma proposta de comunicação de ciência procura combinar métodos de comunicação com aspectos inovadores de educação. O grande objectivo é o de mostrar como estas ferramentas inovadoras criam bases de conhecimento e motivação para levar os jovens, no fim do secundário, a desenvolver uma cidadania responsável, fundada no conhecimento científico adquirido sobre o impacto ambiental e social do excesso de azoto.

A consulta pública sobre o conhecimento e as opiniões dos professores sobre esta matéria realizada no início de 2014, foi fundamental para a conclusão da presente proposta de candidatura ao Horizonte 2020. Enquanto método qualitativo estruturado, mas também flexível e informal, o focus group permite uma recolha de opiniões baseada no debate e na consensualização; e esta é uma das suas vantagens face à entrevista individual. A análise dos dados assim recolhidos veio confirmar o que já tinha sido discutido e apresentado no ENA (European Nitrogen Assessement) em 2011. Os problemas associados ao azoto são tão complexos que a maioria prefere valorizar a componente indirecta, responsável por potenciar as alterações nas

emissões de CO_2 e do clima, cujos ícones ambientais entraram já no léxico da sociedade.

A consulta pública, por via do método focus group, mostrou a visão dos participantes, as suas preocupações, dilemas e recomendações. Tratando-se de um grupo em contacto directo e constante com os estudantes, a sua visão e modo de actuar foram decisivos para o desenho conceptual da proposta a submeter à Comissão Europeia.

Porquê uma proposta de dimensão europeia, e não apenas a nível nacional? Assistimos nos últimos anos a um aumento generalizado da informação disponível sobre o aumento de azoto no ambiente, tanto na internet como em recursos facilmente acessíveis. Tal como se verificou para as alterações climáticas, ou as medidas de mitigação, esta disponibilidade e acessibilidade reforçou o alerta sobre o problema. Mas as mudanças de valores e atitudes são naturalmente as mais lentas e ineficazes, já que têm de vencer hábitos profundamente arreigados e ditames sociais resistentes. No caso do azoto, cuja mensagem icónica é mais difícil de transmitir, há que envolver toda uma nova geração, recorrendo a estratégias de comunicação científica inovadoras e de grande responsabilidade social. Para uma comunicação eficaz é necessário potenciar a acção local, adaptada a cada grupo etário da população, mas com dimensão global e europeia. Por outro lado, não basta que os jovens sejam "ensinados" ou alertados, devem antes testar por eles próprios para serem sensibilizados, confrontar-se com a consequência de atitudes alimentares, estabelecer ligações entre as doenças da sociedade actual e as dos seus avós ou familiares, compreender como uma tecnologia pode originar prós e contras em toda a sociedade, confrontar os dilemas de saúde dos Portugueses com os dos Ingleses, e não ter receio de tomar opções responsáveis consentâneas com a problemática e os objectivos europeus.

Garantir um ensino de qualidade e motivador nos três últimos anos do secundário é crucial para que os estudantes adquiram as competências mais adequadas ao seu desenvolvimento pessoal e profissional. A qualidade da educação depende de indivíduos e de instituições dedicadas, apoiados por políticas centradas no ensino e na aprendizagem. O modelo aqui proposto é, portanto, um modelo baseado na trans-disciplinaridade, privilegiando a interdisciplinaridade na escola – uma articulação de disciplinas em torno do tema do azoto -, e a ligação entre escolas, institui-

ções científicas, ensino superior, associações de pais e outras organizações cívicas não governamentais. Apesar desta proposta ser dirigida aos estudantes, o pessoal docente recebe formação e apoio sobre metodologias de aprendizagem activa, para melhor reforçar a motivação dos seus estudantes. A inovação que aqui se propõe inclui a qualidade e relevância do ensino experimental, tendo como garante o ajustamento aos conteúdos escolares. Ao promover um acompanhamento tutorial ao longo dos três últimos anos, com uma parceria estreita entre escola e ensino superior, os estudantes serão incentivados a desenvolver novas capacidades de comunicação, a estabelecer trocas de conhecimento com os seus colegas europeus, a responsabilizar-se pela sua aprendizagem e percurso escolar. Em suma, ao concluir o ensino secundário, os estudantes estarão mais motivados para prosseguir as suas carreiras, participar em organizações cívicas, com previsível impacto em termos de número de diplomados, mas também de hábitos de cidadania activa. Este é um dos objectivos da proposta a submeter, e que se insere na estratégia mais ampla da Comissão «Europa 2020», a qual visa promover o crescimento e o emprego, com o contributo essencial da educação e da formação das novas gerações.

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FACULDADE DE CIÊNCIAS SOCIAIS E HUMANAS
UNIVERSIDADE NOVA DE LISBOA

INSTITUTO DE TECNOLOGIA QUÍMICA E BIOLÓGICA /UNL
Knowledge Creation

Nitrogen (N): from science to society

Maria Amélia Botelho de Paulo Martins Campos Loução

ANEXO

Lisboa (Março 2014)

Consulta Pública

Fertilizantes: um século de vida ou de morte?

Maria Amélia Martins-Loução

Explicar

Focus Group

Maria Amélia Martins-Loução

Focus Group

- Discussão em grupo de um tópico em particular
- Comunicação e partilha de conhecimentos
- Todos os contributos são válidos
- Não há respostas certas ou erradas
- Informalidade na participação

Maria Amélia Martins-Loução

Focus Group

Maria Amélia Martins-Loução

Formulário de Consentimento Informado

Foi convidado a participar neste *focus group* que tem por objetivo ficar a conhecer as ideias e as propostas de resolução para minimizar a produção e acumulação de compostos reactivos de azoto (Nr) no ambiente.

O estudo é realizado no âmbito de um trabalho de tese de mestrado em Comunicação de Ciência. Os resultados aqui obtidos e discutidos serão utilizados para elaborar um projecto de desenvolvimento a propor às escolas e instituições de investigação e desenvolvimento.

A participação neste *focus group* deverá demorar cerca de 3 horas. No grupo de discussão, ser-lhe-á pedido que participe numa discussão sobre o uso de compostos de azoto, nomeadamente fertilizantes, e consequência da sua acumulação a nível do ecossistema global. A participação neste projeto é **voluntária**. Por isso, se sentir qualquer desconforto, pode sair do grupo de discussão a qualquer altura. Respeitamos o seu direito de optar por não responder a perguntas que possam fazer com que se sinta desconfortável.

Tenha em atenção que a natureza dos grupos de discussão impede que se possa garantir total confidencialidade. Pede-se aos participantes do grupo que respeitem a privacidade, mas não se pode impor o cumprimento desse princípio.

São esclarecidas quaisquer dúvidas que possam surgir.

	Assinale a caixa	
	Sim	**Não**
Confirmo que li e que compreendo a informação disponibilizada acima.	☐	☐
Compreendo que a minha participação é voluntária e que posso retirar-me a qualquer altura, sem apresentar um motivo.	☐	☐
Aceito que o grupo de discussão seja sujeito a gravação de som/vídeo.	☐	☐

Pode guardar esta página para os seus registos. Assine em baixo se compreender e aceitar as informações acima. Se não compreender alguma parte da declaração pode pedir para esclarecer dúvidas que tenha.

Nome do participante	Data	Assinatura

Nome do moderador Data Assinatura

Avaliar conhecimentos

Maria Amélia Martins-Loução

Para a população humana

Qual a descoberta científica mais importante do séc XX?

Maria Amélia Martins-Loução

Contextuar

Maria Amélia Martins-Loução

A importância do azoto

Porquê ?

Maria Amélia Martins-Loução

A importância do N

- Vivemos num planeta onde 78% da atmosfera é azoto (N)
- Os seres vivos são maioritariamente constituídos por carbono (C), azoto (N) e água (H_2O)
- O N na atmosfera - N_2 - tem de ser fixado para passar à forma mineral (**N reactivo, Nr**)
- O **Nr mineral** é assimilado pelas plantas e microrganismos e transformado em N orgânico
- Os animais, incluindo o Homem, estão dependentes do N orgânico

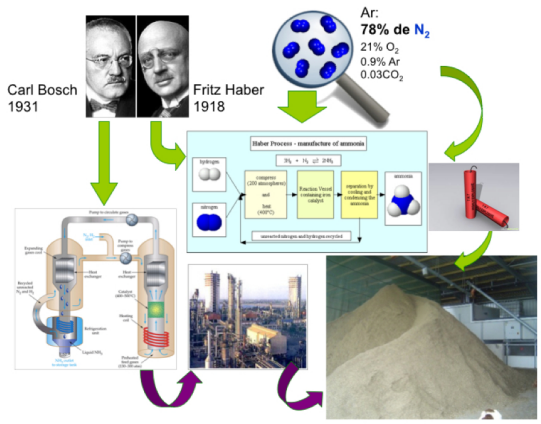
Maria Amélia Martins-Loução

A necessidade

1 A presença de Nr é **essencial** para a produção de alimento

2 Mas a quantidade de Nr produzido de forma biológica (solo, microorganismos) não **chega** para alimentar a população

Maria Amélia Martins-Loução



Fertilizantes azotados - Produção de Nr

A descoberta revolucionária

Maria Amélia Martins-Loução

Carl Bosch
1931

Fritz Haber
1918

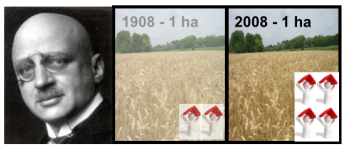
Fertilizantes azotados - Produção de Nr

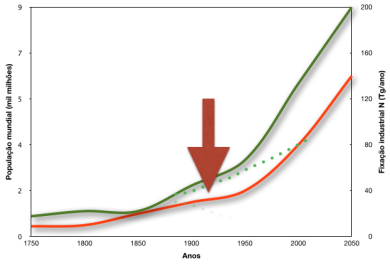
A descoberta revolucionária

Maria Amélia Martins-Loução

Inventariação de conceitos

Maria Amélia Martins-Loução





Fertilizantes azotados

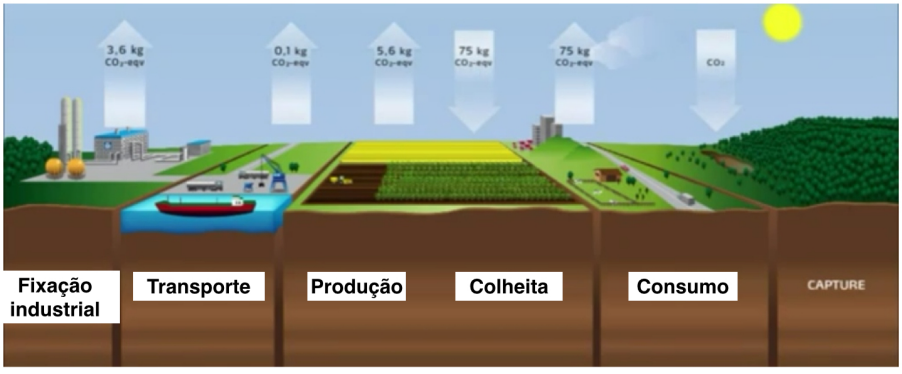
O benefício para a Humanidade - mais de 50% da população não estaria viva

Maria Amélia Martins-Loução

Produção de Nr industrial

Produção de alimento - para a Humanidade viver e de PÓLVORA - para matar

Maria Amélia Martins-Loução



A necessidade de alimento

Os custos energéticos

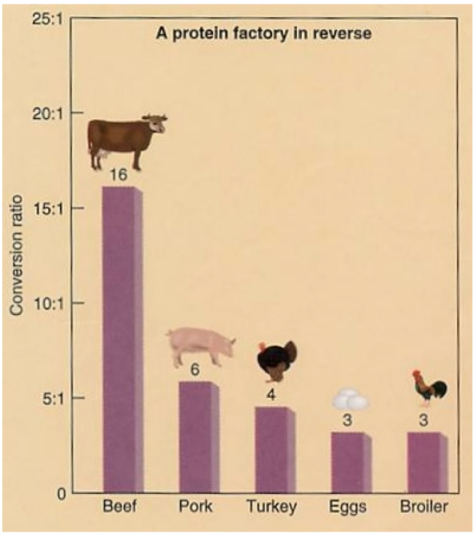
O planeta tem condições para continuar a suportar os custos energéticos e a emissão de gases de estufa?

Maria Amélia Martins-Loução

Produção de Alimento

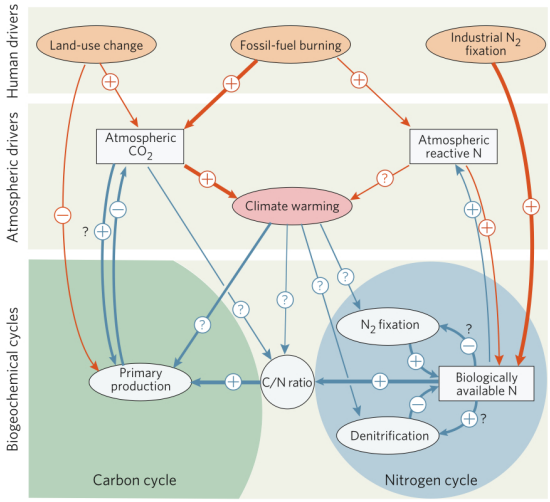
Os custos energéticos

A produção de 1kg de carne de vaca necessita de 16 kg de vegetais. Ou seja, a produção necessária para alimentar uma pessoa a bife podia servir para alimentar 16 pessoas.



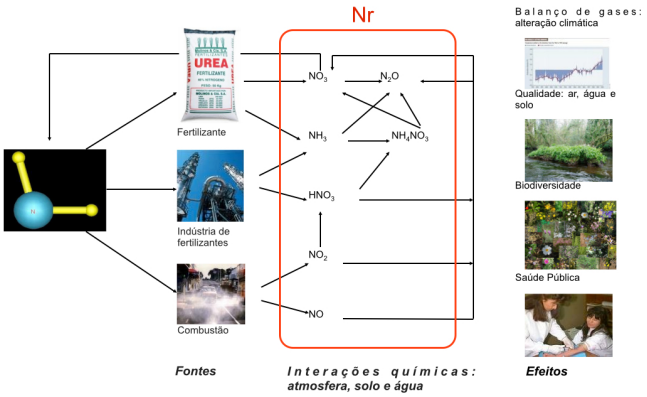
As interacções N-C-Clima

A acção do Homem



Galloway, 2008

A cascata de efeitos no ambiente natural e urbano

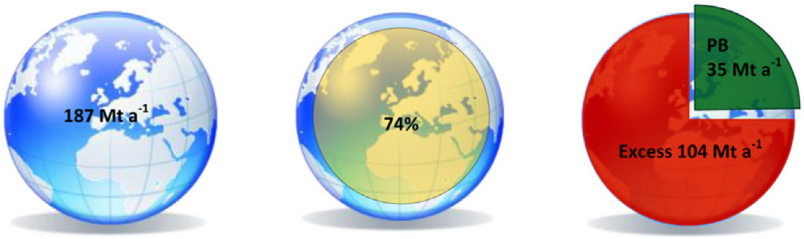


A presença de Nr afecta os nossos recursos básicos

Maria Amélia Martins-Loução

Fluxos actuais | Produção de alimento | Barreira planetária

Conversão de N_2 a Nr



Fluxos actuais de N no globo

A produção de alimento e a industria dos fertilizantes

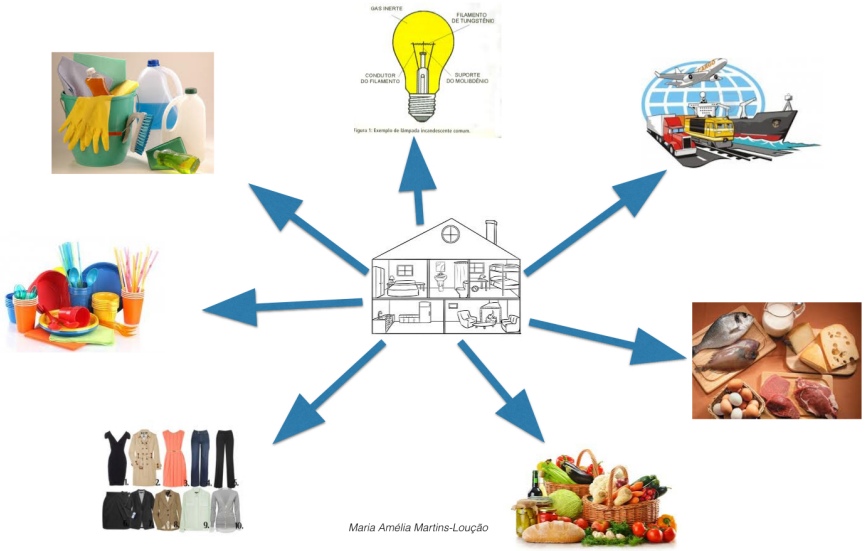
Maria Amélia Martins-Loução

Kahiluoto et al. 2013

Selecção de conceitos

Maria Amélia Martins-Loução

O N na sociedade



Maria Amélia Martins-Loução

1º Exercício - individual (20 min)

Pensando no vosso caso pessoal qual o vector que poderá contribuir mais para **a acumulação de Nr** no ambiente:

- consumo de energia
- transportes,
- plásticos, produtos de limpeza e desperdícios de água,
- factores externos de riqueza (roupas, carros, móveis, casas, entretenimento)
- alimentação

Explorar os conceitos

Os desafios do séc. XXI

Como alimentar 9 mil milhões de pessoas em 2050?

Como evitar ou minimizar a produção e acumulação de Nr ?

Maria Amélia Martins-Loução

2º Exercício - (20 min)

Que **obstáculos / problemas** para reduzir a produção e acumulação de Nr no ambiente:

- diminuir consumo de energia ?
- utilizar menos transportes ?
- utilizar menos fertilizantes: agricultura biológica?
- alterar hábitos alimentares: carnívora *vs* vegetariana ?
- educar?

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Definir as acções

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3º Exercício - individual (20 min)

- Perante os obstáculos que identificou refira os problemas que encontra para a sua resolução?

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Agrupar as soluções semelhantes

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4º Exercício - em grupo (20 min)

- Pensar em possíveis soluções para a resolução dos problemas?
- (Colocar uma solução em cada folha)

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Priorizar as acções

Maria Amélia Martins-Loução

5º Exercício - individual (20 min)

Se lhe fossem dados 5 milhões de euros em qual das soluções apresentadas investiria ?

Maria Amélia Martins-Loução

Discutir e debater as soluções apresentadas e mais votadas

Maria Amélia Martins-Loução

Questionário de Avaliação

Caro Participante,

Obrigado por ter participado neste evento. Gostaríamos agora de lhe fazer algumas perguntas sobre o evento como parte da nossa avaliação; ficaríamos muito gratos se pudesse preencher este questionário. Pode ter a certeza de que as suas respostas serão tratadas como dados anónimos.

Obrigado pela sua colaboração.

1. Qual é o seu nome (apenas iniciais)?
   ……

2. A informação que lhe foi disponibilizada antes do evento foi esclarecedora relativamente ao tópico em questão?

   Sim

   Não

   Não tem a certeza

3. Durante o evento, teve oportunidade de dizer o que queria?

   Disse tudo o que queria dizer
   Disse a maior parte do que queria dizer
   Só consegui dizer um pouco do que queria dizer
   Não tive oportunidade de dizer nada

4. Houve tempo suficiente para discutir tudo o que era necessário?

   Sim

   Não

   Não tem a certeza

5. Acha que havia questões relevantes relacionadas com o azoto (fertilizantes) e saúde que NÃO foram discutidas, mas que deviam ter sido discutidas? Quais ?

   ……

   ……

   ……

6. Aprendeu muito sobre azoto (fertilizantes) e saúde neste evento?

   Aprendi muitas coisas novas
   Aprendi algumas coisas novas
   Não sei se aprendi alguma coisa nova
   Não, não aprendi nada de novo
   Explique o que aprendeu:

   ……

   ……

   ……

7. A participação neste evento fez com que mudasse os seus pontos de vista relativamente às questões em causa?

   Sim, mudei os meus pontos de vista consideravelmente
   Sim, mudei um pouco os meus pontos de vista
   Não sei se mudei ou não os meus pontos de vista
   Não, não mudei os meus pontos de vista de todo

   Explique de que forma isso aconteceu ou vai acontecer:

   ……

   ……

8. Acha que as suas atividades no local de trabalho e em casa vão mudar?

   Sim

   Não

   Não tem a certeza

   Explique de que forma:

   ……

……

9. De um modo geral, quão satisfeito ficou com o evento?

   Muito satisfeito

   Algo satisfeito

   Nem satisfeito nem insatisfeito

   Não muito satisfeito

   Nada satisfeito

   Não tem a certeza

10. De um modo geral, qual foi o melhor aspeto do evento?

    ……

11. De um modo geral, qual foi o pior aspeto do evento?

    ……

    Mais uma vez, obrigado pelo seu tempo. Entregue o seu questionário preenchido ao organizador do evento à saída.